



# The Journal of Bone and Joint Surgery

The Official Publication of the  
AMERICAN ORTHOPAEDIC ASSOCIATION  
and the BRITISH ORTHOPAEDIC ASSOCIATION

January 1935

*Editor, E. G. BRACKETT, M.D.*

8 THE FENWAY, BOSTON, MASSACHUSETTS, U. S. A.

II. No. 1

*Published Quarterly*

Old Series: Vol. XXXIII. No. 1

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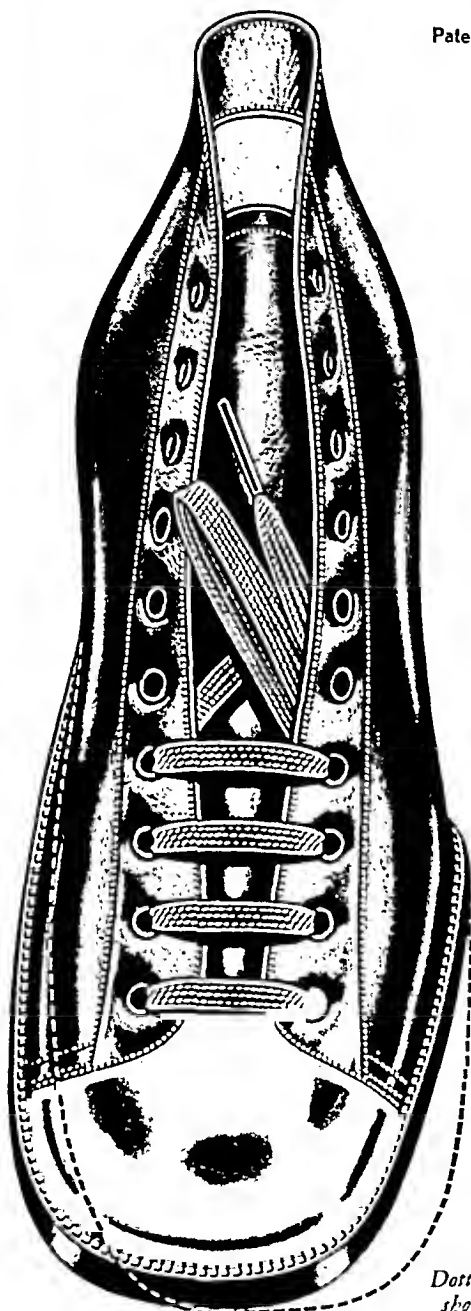
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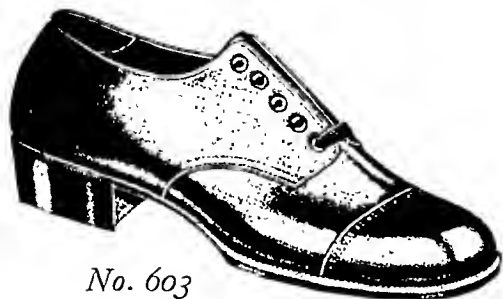
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THE EDITOR

THE JOURNAL OF BONE AND JOINT SURGERY

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The Official Publication of the  
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VOLUME XVII  
OLD SERIES - VOLUME XXXIII  
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# The Journal of Bone and Joint Surgery<sup>\*</sup>

The Official Publication of the American Orthopaedic Association and  
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VOL. XVII, No. 1

January, 1935

Old Series  
VOL XXXIII, No. 1

Editor, E. G. BRACKETT, M.D. Assistant Editor, FLORENCE L. DALAND  
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THE JOURNAL OF BONE AND JOINT SURGERY

8 The Fenway, Boston, Massachusetts, U. S. A.

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# The Journal of Bone and Joint Surgery

## CONGENITAL LUXATION OF THE HIP

### SELECTION OF CASES FOR OPEN REDUCTION \*

BY ALBERT H. FREIBERG, M.D., F.A.C.S., CINCINNATI, OHIO

*From the Department of Orthopaedic Surgery, University of Cincinnati, Medical School*

Even with an acknowledgment that there is a place for both the open and the closed methods of treating congenital misplacement of the hip, it is no light task to lay down the indications for each. To the degree to which one's experience is spread over years, the task becomes more difficult. One comes to realize the extent to which personal aptitude with either method determines a preference, and that this method does not necessarily lead to a better result than that which has been attained by another who has chosen the alternative for a similar reason. For him whose professional career embraces that whole span of time during which it has been possible to treat this condition effectively, there has also to be overcome the indelible impression of what were really great triumphs in a field which had been so recently regarded as entirely barren. It becomes necessary for such a man to pause and realize in what measure both methods have become improved, so that their relative advantages and disadvantages are no longer the same as when first used.

The treatment of this condition was popularized by Hoffa and Lorenz, originally, on the basis of their experience with the open method. This method was forsaken by both of them, because of the operative risk which was then involved, and after they had learned how to accomplish a true reduction by the closed method. Although Paci had published his original paper on the closed method in 1887, at the Eleventh International Congress in Rome, in 1894, Lorenz contended that reposition must fail by any closed method. This was on the basis of 100 cases of open reduction, and because in all of them the ligamentum teres was found so thickened and the acetabulum so small that these made reductions impossible. Notwithstanding this, in the year 1896, we find both Hoffa

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester, Minnesota, June 7, 1934.

and Lorenz advocating the closed method as the one to be preferred. If I cannot forget the sight of a child with both hips ankylosed after open procedures for this condition in a European hospital, neither do I forget that in earlier days myorrhesis of the adductors was normally a part of the closed procedure, and I have very distinct memories of the laudations, consequent upon the demonstration of a "marvellous combination of incredible manual strength and uncanny delicacy", with which our public prints abounded at one time. In 1920, Galloway put forward the proposal that the open method should become the normal one for even the very young children, denominating the manipulative, or so called "bloodless" methods as "blind, irrational, and deplorably uncertain in results". In his paper of 1926, Galloway speaks of approaching these cases no longer "with a feeling of dread or uncertainty, but with confidence that the treatment is simple, safe, and practically certain to result satisfactorily".

In the meantime, and since the day when Galloway wrote his first paper, it is safe to say that hundreds of children in whom dislocation of the hips was reduced by the closed or manipulative method have grown to maturity and are today unaware of any physical shortcomings whatever. It is also significant that in Italy, where the frequency of congenital luxation is possibly greater than in any other land, the closed reduction is still the prevailing method of choice. Even though it be also admitted that, through wide-spread propaganda, Putti has succeeded in accomplishing much earlier recognition of these luxations, this does not lessen the validity of the statement. The open reduction has been advocated for the very young in terms no less definite than for patients over three years of age. If, for the sake of fairness, it must be stated that Galloway has shown that ideal results may be obtained by the open method in children under three years of age and with reasonable safety, then it is likewise necessary to say that his youngest patient, reported in the series of cases of 1926, was seventeen months of age and that he posits the age period from twenty months to two years as the ideal age for the open operation.

The advocate of the closed method is at the same time the advocate of very early recognition. He will feel entitled to observe that with such recognition and the practice of today's technique, the dislocations in his cases will almost invariably be perfectly reduced, by a method free from violence, before that age period has been attained, which has been proclaimed ideal for the open procedure. The advocate of the closed method will also inquire: "What things are done to the child under three years, by a thoroughly qualified worker, which would, even in slight measure, interfere with the later use of the open operation in the case of insuccess with the closed?" He may feel entitled to inquire: "Is not the day of 'manhandling' of these young children past? Are not some of the very early cases reducible without any 'manipulation', in the narrower sense, and simply by means of properly applied and maintained position in abduction?" It would seem justifiable to insist that, even though it may

have been shown preferable to choose an open procedure rather than to push manipulation to the point of violence, where this would otherwise be unavoidable, this should by no means relieve us from the duty of cultivating the highest degree of proficiency in the use of a mild and harmless method which offers great promise of success. It would, on the contrary, seem proper to demand that the thoroughly trained orthopaedic surgeon be a master of both methods.

In discussion of the indications for the closed and open methods of reduction of congenital dislocation of the hip, I apply myself solely to the question of "reduction" of these misplacements and not to those palliative methods which are proposed for cases in which true reduction and cure are not to be considered. Unless one be an advocate of either the closed or the open method to the exclusion of the other, it would appear that there should be recognized three classes into one of which every case may be placed:

- I. Those in which closed reduction should, doubtless, be attempted.
- II. Those in which the advisability of even attempting closed reduction is debatable.
- III. Those in which closed reduction is obviously out of the question, because of age, marked deformity, or personal structure.

To a group as experienced and as thoroughly trained as this one, it is not to be expected that arbitrary limits of age will be set down. It will be apparent, to the majority at least, that within certain age limits the indications and contra-indications are relative; that they are dependent upon certain personal structural characteristics, as well as upon the degree and character of local deformity.

It is obviously of importance in making a decision, especially in children who have walked much and therefore are five or more years of age, to consider whether we have to deal with single or double luxation. And yet I have distinct recollection of two children who were under my care at one time, some years ago. Each was seven years old and each had unilateral luxation. The boy was of delicate fiber with about one and one-quarter inches of shortening and free up-and-down mobility of the femur. Reduction by manipulation was remarkably easy and satisfactory. I was able to observe him for quite a long time and the cure was apparently perfect when I saw him last. The girl was of stocky build with firm muscles and but little vertical mobility. Reduction by closed method was difficult. It required much force but was apparently complete, as indicated at the operation and by x-ray afterwards. Yet this child had a fairly stiff hip in considerable abduction when last seen about one year after reduction, when we lost track of her.

I present the roentgenogram (Fig. 1) of a boy with bilateral luxation who was eleven years old when manipulation was done in January, 1925. He was strongly muscled with limited vertical mobility. Unfortunately the original roentgenograms of this case cannot be found. Reduction of

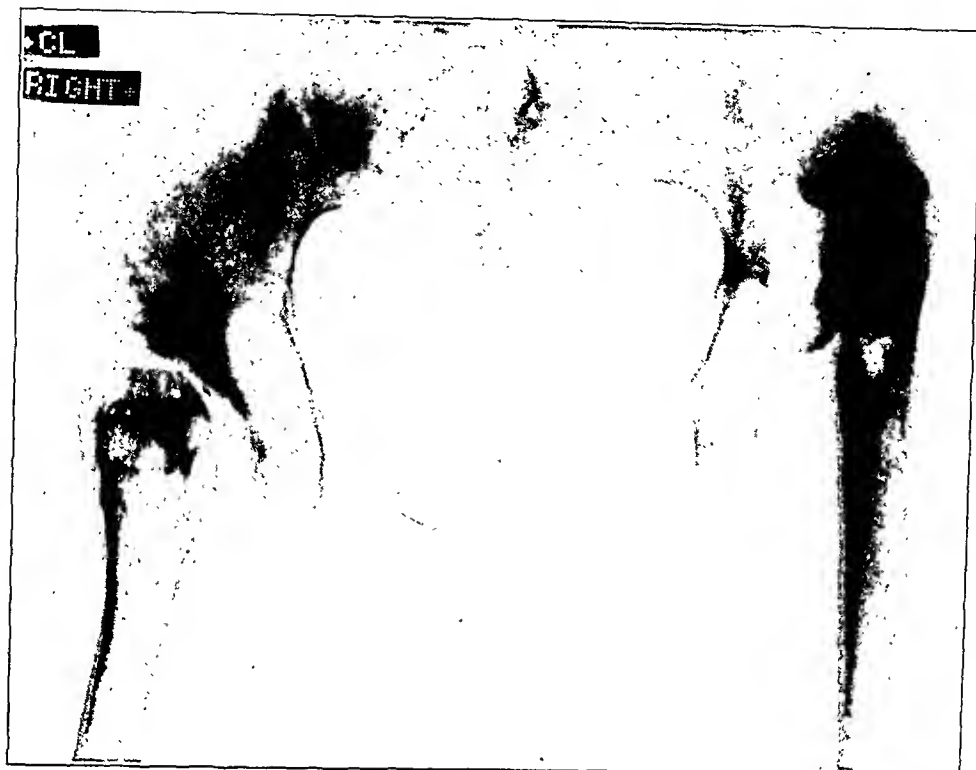


FIG. 1

Boy twenty years old. Right hip was reduced nine years ago with use of much force; left hip could not be reduced. His present condition is here shown.

the right hip was accomplished by manipulation with much difficulty and force. The attempt at reduction of the left hip was unsuccessful on two later occasions. No further opportunity for reduction was given. The reduced hip was fairly stiff in 45 degrees of abduction in February 1926, one year after reduction. The roentgenogram shown was made in March, 1934, at the age of twenty. Aside from the marked shortening of the left leg and consequent limp, the boy has no complaint to make and claims great endurance. Flexion of the right hip is limited to 100 degrees, adduction to 75 degrees, abduction is quite free, and both rotations are much limited. The roentgenogram shows marked depression and shortening of the femoral neck and deformity of the head. It seems likely today that open reduction would have held out to such a case, not only the replacement of both hips, but probably replacement without that degree of subsequent deformity and functional impairment which is found in the right hip.

The x-ray is informative in young children with regard to the relative positions of femur and pelvis. However, up to the age of six it may be very deceptive with regard to the degree of deformity, both as respects the head and the acetabulum. What we see depicted is, of course, not the shadow of the head, but only of its ossific nucleus. Even in normal children of this age, there is variation in the proportion of bone nucleus and epiphyseal cartilage. In congenital luxation this variation

is much greater. In fact, as many may have observed, these proportions frequently differ quite plainly in the two hips of the same child. In like manner, even though less easy to appreciate, this is true of the acetabulum. Concerning the situation with regard to the soft parts of the joint, particularly the isthmus of the capsule, we may make no decision before attempted reduction. If, therefore, without the attempt at manipulative reduction at what is usually considered a favorable age, we were to proceed routinely with an open reduction, in many cases we should unquestionably perform such operations on patients who would have responded to manipulation without incision in the happiest manner possible. Latter-day manipulative technique calls for the abstention from real violence. Has the experience been recorded by any one which would make it appear that subsequent open operation is more hazardous or less successful, if reasonable limits of force have not been transcended and a judicious period of time permitted to elapse? It does not so appear.

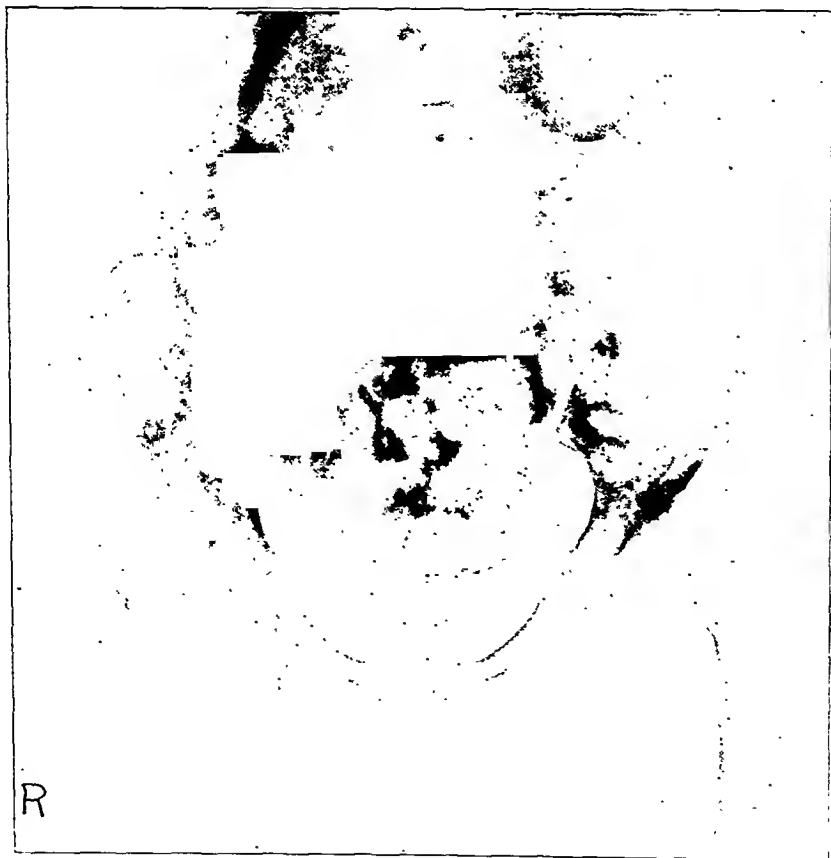


FIG. 2

Girl five years old. Both hips luxated. Roentgenogram before reduction.





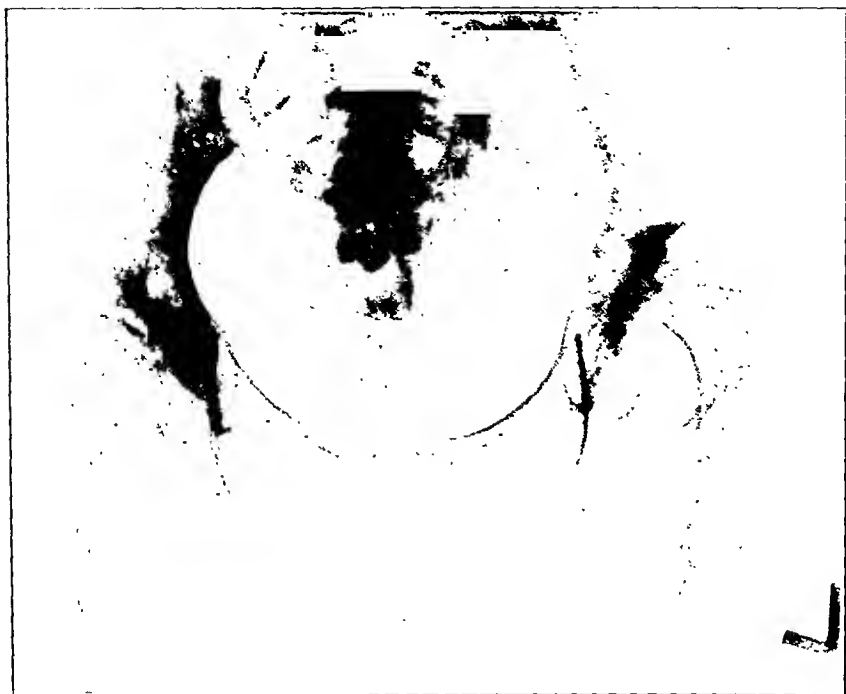


FIG. 4

The same patient eight years after reduction. Subluxation of left hip with instability.

Such an example is shown in the daughter of a colleague who was first seen at five years of age, in September, 1925. Both hips were out; the right femur was displaced laterally more than the left, but the acetabula were considered about alike (Fig. 2). Reduction of both hips was easily accomplished, but it was noted that on the left side the reduction was without the snap which we like to feel. One year later she walked with only the trace of a limp and the Trendelenburg test was definitely negative on both sides. The length of the legs was equal. In 1928, three years later, it was noted that there was a slight limp, with negative Trendelenburg and one-quarter of an inch shortening of the left leg. The roentgenogram (Fig. 3) shows both femoral heads to have abundant thrust under the acetabular roof; about one fourth of the left femoral head is projecting beyond the rim of the acetabulum; on the right there is much less projection. In 1932, a considerable change was observed. The girl had developed sexually to a marked degree and grown much in height. The limp had greatly increased and she had discomfort and fatigue after long walks. The Trendelenburg sign was now positive on the left side and shortening of one-half inch was present. The roentgenogram showed striking change in both hips in so far as the heads of the femora had become uncovered to a much greater extent, the left having moved definitely upward. In January, 1933, the differ-

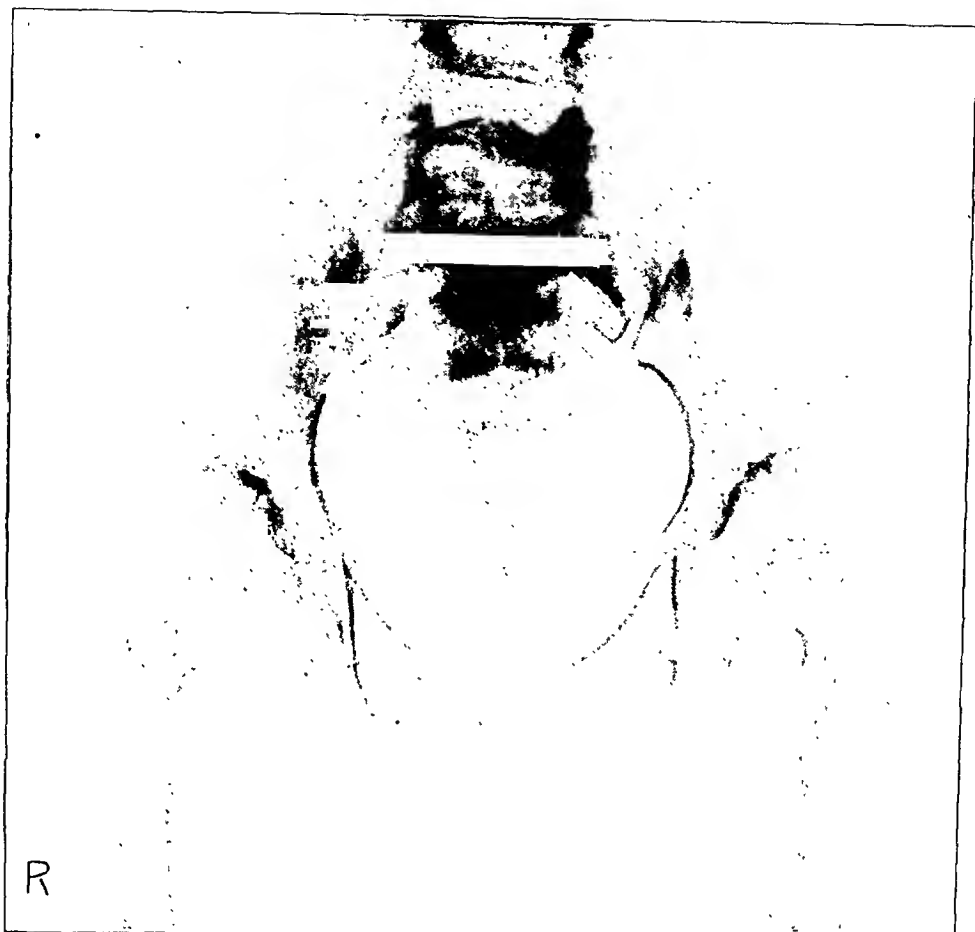


FIG. 3

The same girl's hips three years after reduction by manipulation.

It would seem, *a priori*, that the one great advantage of the open method lies in greater facility and certainty in disposing of the difficulties offered by a narrow capsular isthmus, redundant material in the socket, or the ligamentum teres. But we have no means of determining the existence of such hindrances beforehand without the trial at reduction. On the other hand, if much shortening and muscular resistance constitute the great obstacle, this would be no more easily overcome with one method than with the other. Similarly when we find reduction blocked by reason of disproportion between head and socket, we shall find the open procedure to be inadequate; reaming out of the acetabulum and paring down of the femoral head have too often been followed by stiffness to be considered satisfactory, particularly in the older children where the need is apt to be felt. On the other hand, there can be no doubt that, as we study the end results of our closed reductions more thoroughly, and, therefore, into the period of maturity, we shall find cases which were satisfactory to us in the beginning but which later showed definite evidence of structural deterioration; marked limp, discomfort, or pain and even definite relaxation may appear.

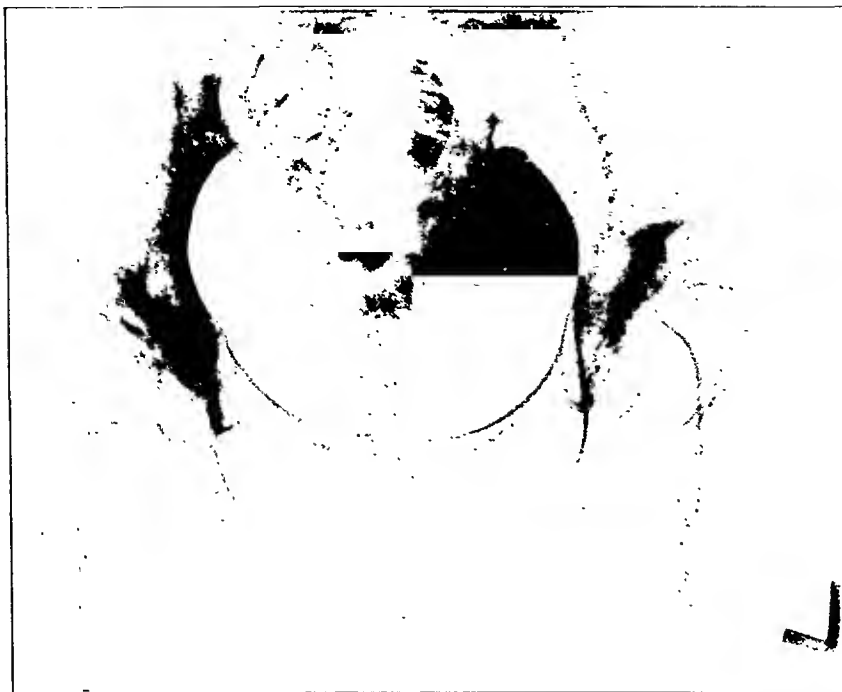


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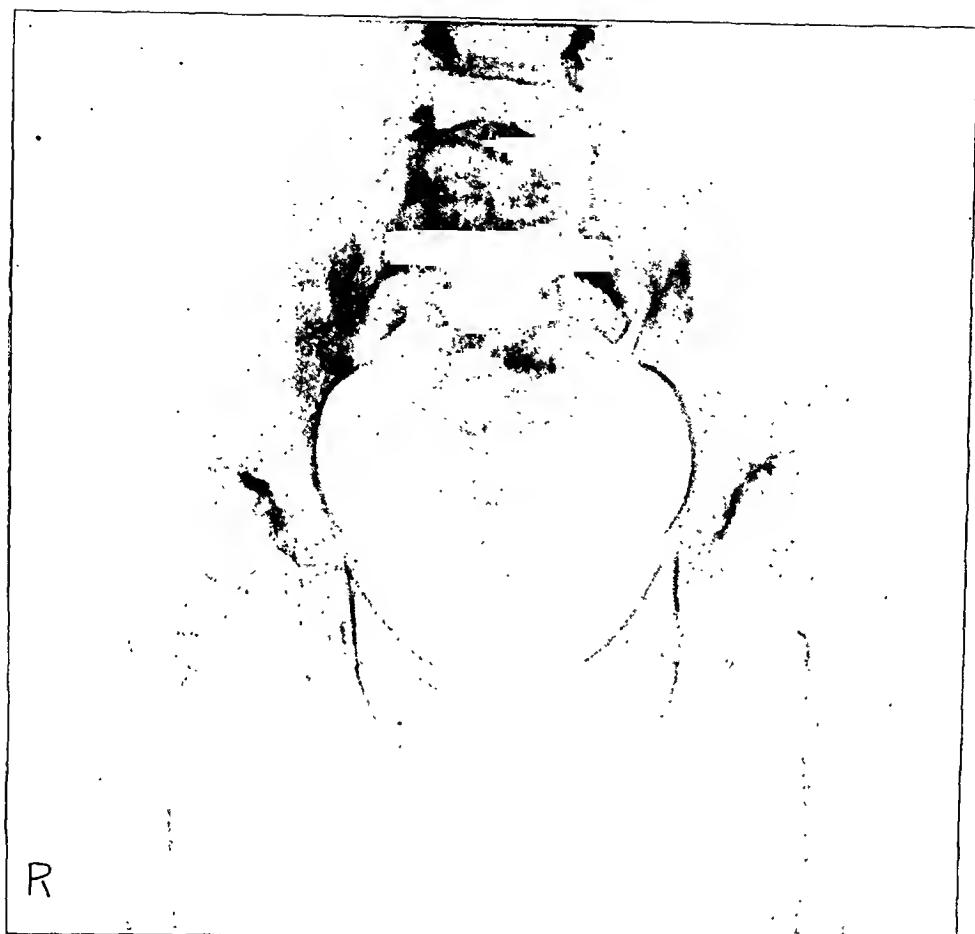


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# CONGENITAL LUXATION OF THE HIP



FIG. 4

The same patient eight years after reduction. Subluxation of left hip with instability.

Such an example is shown in the daughter of a colleague who was first seen at five years of age, in September, 1925. Both hips were out; the right femur was displaced laterally more than the left, but the acetabula were considered about alike (Fig. 2). Reduction of both hips was easily accomplished, but it was noted that on the left side the reduction was without the snap which we like to feel. One year later she walked with only the trace of a limp and the Trendelenburg test was definitely negative on both sides. The length of the legs was equal. In 1928, three years later, it was noted that there was a slight limp, negative Trendelenburg and one-quarter of an inch shortening of the left leg. The roentgenogram (Fig. 3) shows both femoral heads to be in an abundant thrust under the acetabular roof: about one fourth of the femoral head is projecting beyond the rim of the acetabulum; on the right there is much less projection. In 1932, a considerable change was observed. The girl had developed sexually to a marked degree and grown much in height. The limp had greatly increased and she had discomfort and fatigue after long walks. The Trendelenburg sign was now positive on the left side and shortening of one-half inch was present. The roentgenogram showed striking change in both hips in so far as the heads of the femora had become uncovered to a much greater extent, the left having moved definitely upward. In January, 1933, the differ-

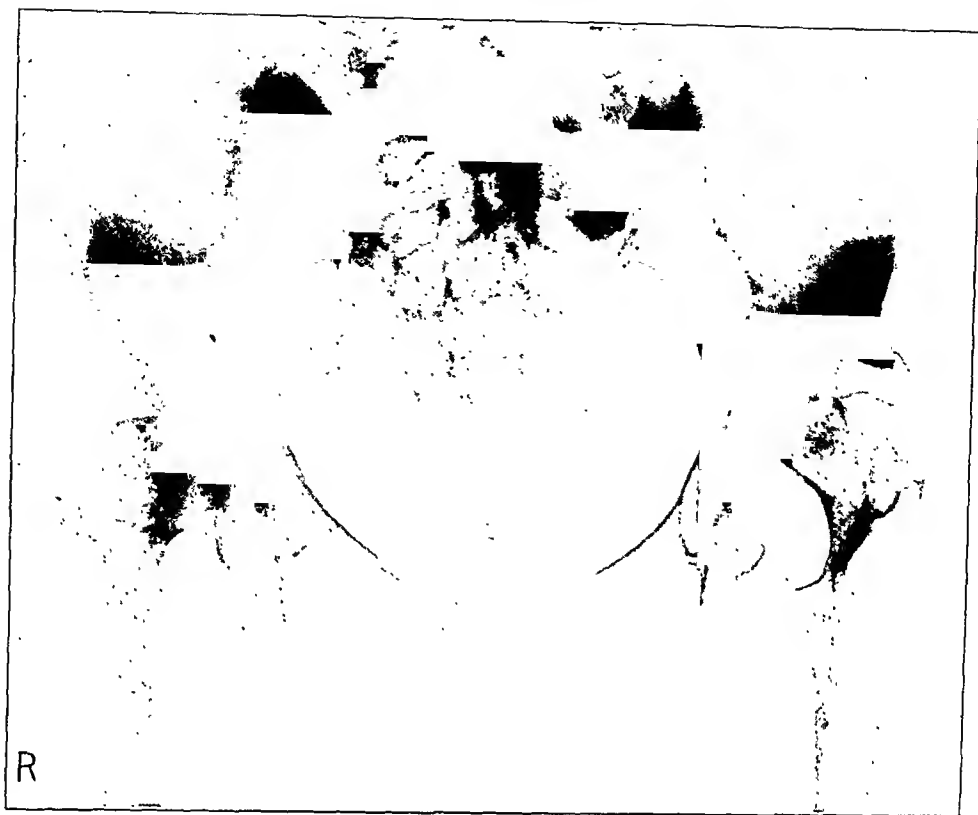


FIG. 5

The same patient one year after shelf operation.

ences between the two sides had become more evident both subjectively and by x-ray (Fig. 4); not quite one-half of the left femur was now covered by socket. For this reason, a shelf operation was done in March 1933, by Dr. Joseph Freiberg, and the result has been very satisfactory thus far (Fig. 5).

The interest in this case lies in the question which must arise with regard to the appropriateness of the original treatment. We ask ourselves in what degree it is likely that an open reduction would have avoided the subluxation which took place. In the failure to obtain the distinct snap which commonly betokens a thoroughly satisfactory reduction we may recognize a difference in the two hips. Should we characterize this as an indication for open intervention? Opposed to this is the evidence of an x-ray fourteen months after reduction which shows abundant thrust for the head and also the very satisfying clinical findings. Not until three years after reduction do we find the observation of increased limp, slight shortening of the left leg, and distinct projection of the femoral heads beyond the acetabular margin. The very obvious change came only with the development of the pelvis at puberty. From this it would seem unlikely that the deterioration in question depended upon any condition which might have been obviated by replacement through incision. It would seem more proper to attribute this change to

a basic difference in the development of the two acetabula and one beyond our power to influence.

From what has been said it will be seen that I am very far from advocating even so much as a partial desertion of the effort at closed reduction in instances where any true reduction seems possible,—i.e., in all cases where it is not evident at once that resort must be had to palliative procedures in lieu thereof. On the contrary, I look upon a well measured, skillful effort at closed reduction as an indispensable preliminary to the conclusion that open reduction is to be recommended. In case satisfactory reduction fails, the advisability of proceeding to open reduction at a proper time is partly decided thereby. I feel like speaking of the closed manoeuvre as a manipulative examination. In about 50 per cent. of all children with congenital luxation of the hip, we are dealing with bilateral involvement. Shall all of them be submitted to two open reductions without our knowing whether even one of the hips may be easily and satisfactorily reduced by the much simpler method of manipulation? I think that my answer to this question has been made plain. At the same time, I think that the open operation has its place as a method of reduction of congenital luxation of the hip, not, however, as a substitute for closed manipulation.

We still have as a task, to labor for the earlier recognition of this condition and to cultivate still greater proficiency in the practice of the closed method. In my judgment, the chief indication for the open method of reduction should be the failure of the closed method in skillful hands. At the same time, I am anxious that this statement should not be construed as justification for reserving the open reduction for patients who are too old for closed reduction. The case which is too old for the closed is likely to be too old for the open reduction also. For such situations the palliative procedures would seem to be in order.

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# THE PHYSIOLOGICAL TREATMENT OF CONGENITAL DISLOCATION OF THE HIP \*

BY STEELE F. STEWART, M.D., LOS ANGELES, CALIFORNIA

The pathology of congenital deformities is sown in heredity, develops in embryo, and fruits under the trade winds of use. Failure to appreciate these elements leads to therapeutic sins; for the treatment is for names, not for conditions. Hope of improved therapy necessitates actual knowledge of the peculiar conditions of each particular patient at the moment of treatment. It is our hope to shed at least a ray of light on so called congenital dislocation of the hip.

These facts about the normal development of the hip are worthy of remembrance:

1. The femur and os innominatum are differentiated from a common skeletal anlage by a mesoblastic invasion; while the foetus, from one to two centimeters long, floats equipoised in an amniotic sea.

2. Within this mesoblastic divisor a cleft appears, which marks the beginning of the hip joint. This cleft spreads laterally till finally the capsule is defined. An incomplete marginal erosion of the mesoblast leaves a capsular fold, which in the knee forms the menisci.

3. The primitive femur is reptilian in form, being without a neck, and having a head which is roughly rectangular.

4. The head is pushed off toward the acetabulum on a cervical bud.

5. The ligamentum teres is formed by a flanking growth of the ends of the rectangular head till finally the ends join, leaving the central ligamentum teres and a hemispherical femoral head.

6. The acetabulum is formed by a parallel and concomitant change in the pelvic portion of the joint, except that the process does not proceed so far, leaving the incisura acetabuli for intra-articular vessels and nerves. The margins of the acetabulum are gradually built up on the tripartite foundation, the last to appear, roentgenographically, being the marginal epiphyses of Morrison.

7. The femoral antetorsion at birth is said to be about 35 degrees and decreases with advancing years to about 12 degrees in the adult.

8. The differentiation of the joint is completed in the ninth week.

Fortunately, while the differentiation of the normal hip is exceedingly complex, most hips come through the embryonic maze perfectly. Occasionally the process is modified or interrupted, and deformity appears. The wider the variation from normal, the rarer does that deformity appear. I can find no instance where the failure of the mesoblastic divisor has left the patient without a hip joint, although such deformities are seen in the elbow and fingers. More frequently, but still

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester, Minnesota, June 7, 1934.

very rarely, an excessive divisor sweeps away the proximal end of the femur or the innominate bone. Probably an unusual plane of the joint cleft brings the femoral head behind the acetabulum, resulting in the so called congenital dislocation of the hip. The process of joint differentiation may not be complete, leaving a deformed capsule; and the alteration of some other developmental factors gives rise to other complicating deformities. Thus an absent cervical bud permits the reptilian caput to remain with the epiphysis running dorsoventrally on the tip of the femoral shaft. We must observe, therefore, that what has been treated as a simple deformity or dislocation is in reality a localized combination of several ontogenic deformities, and that, instead of these being dislocated hips, they are in reality virginal hips whose reciprocating parts have never conjugated.

It would not be surprising, then, should these peculiarities show: (1) a predominance in the female whose monembryonic pelvis has departed farther from the more primitive or polyembryonic pelvis of the male; (2) occasionally a familial occurrence; and (3) even a regional localization, where families have remained relatively non-migratory,—as around Bordeaux, Bologna, and in Japan. Neither is it to be wondered at that there should be occasionally an association with other deformities.

These unconjugated hips usually exhibit the following characteristics:

1. There is an ischial or ilio-ischial deficiency as in the subprimates.
2. The caput lies nearer the acetabulum than the trochanter, as contrasted with traumatic dislocations.

3. Femoral anteversion is higher than normal, averaging 42 degrees in unilateral, and 52 degrees in bilateral cases.

4. The capsule is incompletely differentiated as is evidenced by two facts:

- (a) The capsule ends at the epiphyseal line instead of cervically.
- (b) There is a capsular fold occasionally superiorly and always inferiorly, much like the menisci of the knee.

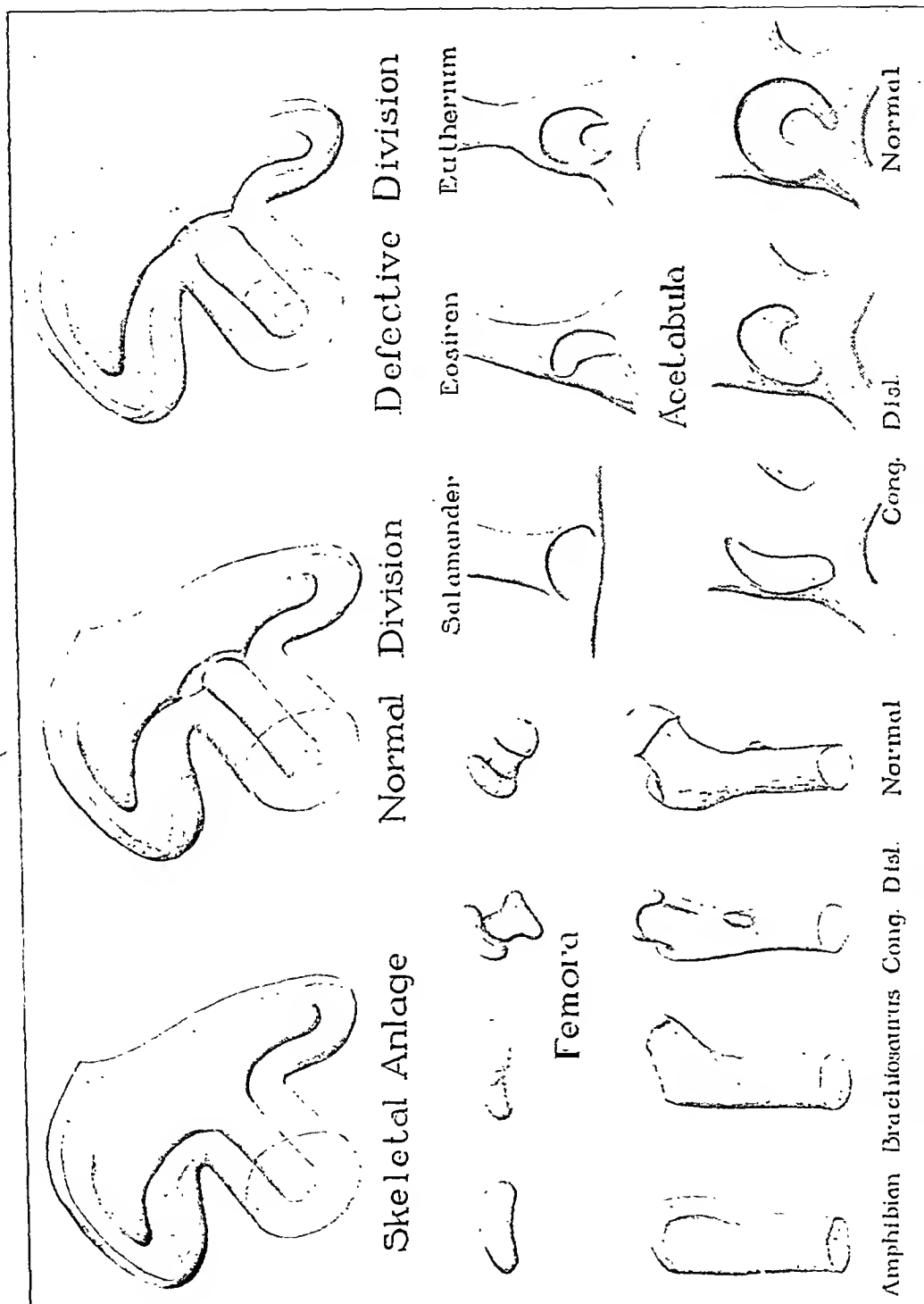
5. The inferior capsule is enormously thickened.

6. An hour-glass constriction is formed by the superior acetabular margin and the inferior portion of the fold of the capsule.

At times one or more of the following deformities may be added to the common defects just outlined:

1. The ligamentum teres may be divided or absent.
2. A lack of capsular differentiation centrally may practically divide the joint into two parts or leave intracapsular bands.
3. There may be no neck, or it may be set at an unusual angle.
4. The head may be of a flat reptilian form or it may appear to be divided.

It immediately becomes apparent that all the preoperative information obtainable is of value in determining a course for successful action, and the only reason for the degree of success already attained by the profession is to be found in the fact that more of these hips approach



normal than vary widely from that mark. The small group which are far from normal require a series of operations or may baffle all attempts at treatment.

All the information obtainable preoperatively may be secured by four roentgenological procedures:

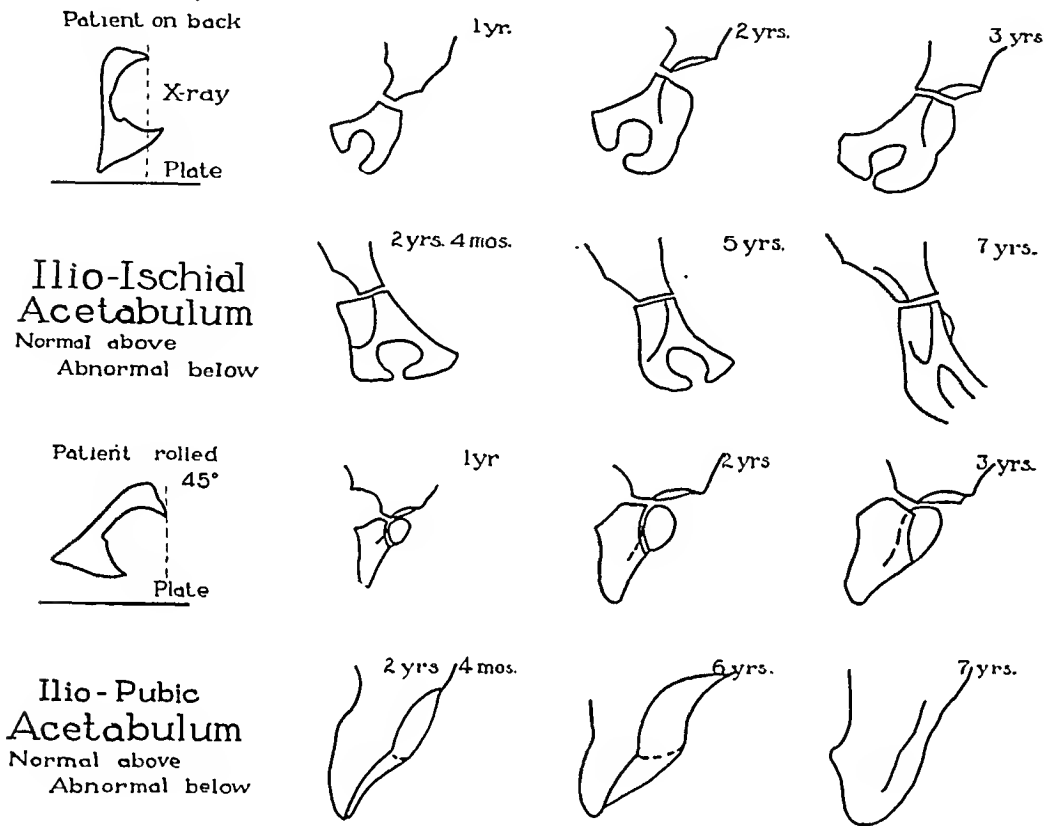


FIG. 2

1. The ossified ilium and ischium are revealed by a flat plate, taken with the back of the patient flat.

2. The ossified pubic acetabulum is revealed by turning the patient 45 degrees on the affected side, and taking a plate with the tube centered directly over the hip.

3. Antetorsion is measured fluoroscopically by the method described by Karshner and myself.<sup>1</sup>

4. The true morphology of the acetabulum, head, and capsule is revealed by a pneumoroentenogram, which fails, however, to reveal intracapsular bands.

The application of these methods, combined with immediate attempts at closed reduction and followed by open surgery, have taught three great lessons:

(a) The degree of antetorsion and the extent of the ischial defect are reciprocal factors,—i.e., a high degree of antetorsion and a well developed ischial acetabular rim are incompatible with retention, and result in the



FIG. 3

Air injection of capsule. Note hour-glass capsule and that capsule ends at epiphyseal line of femur.

K.Y. Female, three years of age. Both hips were unconjugated. Antetorsion of left, 50 degrees; right, 67 degrees. Capsule was exceedingly thick near the acetabulum and only the tip of the scissors could be introduced into the acetabulum on the left side. Acetabulum was deep with dense vertical bands in the acetabulum. Capsule was adherent to the femur at the epiphyseal line. Head was slightly irregular; no round ligament. Legs were stable in neutral position.

anterior reposition of the hip, when the patient attempts to walk normally. Such a condition requires a torsional osteotomy.

(b) Primarily, it is not the defective iliac portion of the acetabulum that causes dislocation when the hip is adducted after conjugation, but it is rather the folding up of the inferior capsule, which levers the hip out of the socket, aided by the shortened adductors—which should be divided subcutaneously before attempting any reduction—and abetted by defective acetabular bearings.

(c) In most, if not all, hips treated by closed reduction, the femoral head must erode its way through the infolded capsule before it becomes completely conjugated; otherwise it will dislocate as it is brought into adduction. It is this erosion, combined with injury to the femoral head, that undoubtedly causes the disabling intra-articular adhesions.

These lessons have been brought to bear on the surgical problem of that large group of hips whose several parts approach normal. In the small series of patients treated at the Children's Hospital during the past two years, most of whom had had one or more attempts at reduction before admission, we have found that the simple splitting of the capsule, from near the lesser trochanter to the incisura, divides the hymen of the acetabulum in such a way that the femoral head can be brought into the

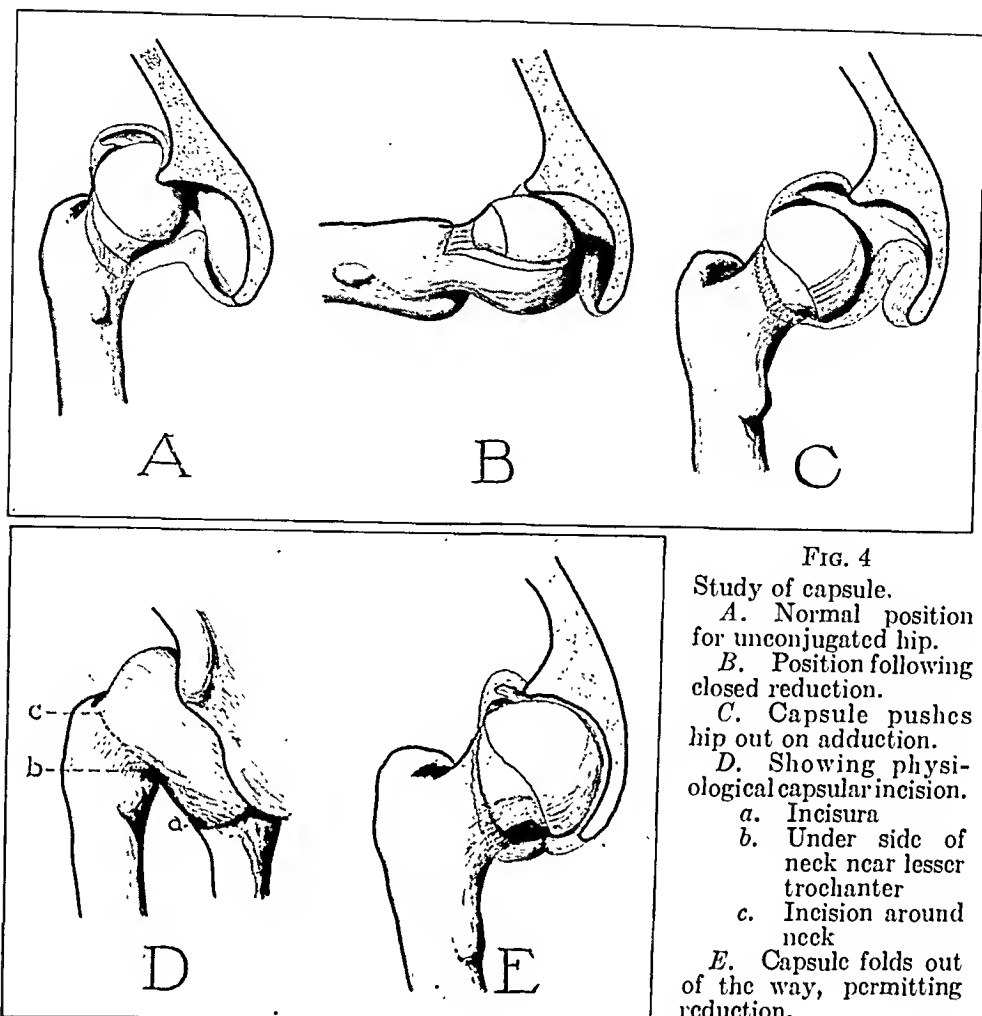


FIG. 4

Study of capsule.

A. Normal position for unconjugated hip.

B. Position following closed reduction.

C. Capsule pushes hip out on adduction.

D. Showing physiological capsular incision.

a. Incisura

b. Under side of neck near lesser trochanter

c. Incision around neck

E. Capsule folds out of the way, permitting reduction.

acetabulum with but the slight force of a finger caught around the femoral neck. (The only exception was in a single case with reptilian femora.) The femoral neck then passes through the capsular barrier. Then the leg may be brought down into 20 degrees of abduction or less with complete stability. The patient is placed in a cast for three or four weeks to permit the wound to heal, after which she is allowed up, walking with only the support of a trochanteric belt.

Any instability of the hip in the lower degrees of abduction bespeaks inadequate acetabular bearings or excessive antetorsion, and these defects should be corrected after healing of the capsular wound in order to avoid unwanted bone production in the scar. Torsional osteotomies should be done through the subtrochanteric region to avoid, as far as possible, any disturbance of the muscular activity of the knee.

We have, therefore, presented a simple surgical approach for the conjugation of these unconjugated hips and have established it on a rational basis of anatomy and physiology. I would again call your attention to the fact that the procedure is applicable only to those unconjugated hips which approach normal in differentiation and development. In no way

does it take the place of the abduction treatment of Putti<sup>2</sup> and Coonse<sup>3,4</sup>, or the simpler trochanteric belt of MacPherson, during the first year of life, when the whole coxal structure is cartilaginous and when there is reasonable hope for a normal structural development under the modulating pressures of use. We "resign to the secular arm" the pump-handling manipulators and the users of racks. We would, however, emphasize the value of marginal additions to the acetabular bearings and we have pointed out the way for their proper localization. In the hips which have retained the reptilian form it would seem that a refined bifurcation operation would be desirable.

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# THE OPEN TREATMENT OF CONGENITAL DISLOCATION OF THE HIP

## THE OPERATIVE TECHNIQUE WITH SOME OF ITS COMPLICATIONS \*

BY WALLACE H. COLE, M.D., ST. PAUL, MINNESOTA

In performing any surgical operation, small changes in technique must be made in practically every case; but the major procedures can be definitely outlined beforehand. This principle can be followed in describing the open reduction of a congenitally dislocated hip. The depth of the acetabulum, the presence or absence of the ligamentum teres, the position of the head of the femur, the tightness of the adductors and other muscle groups, and several other factors may, and frequently do, make necessary minor changes in procedure; but basically the operative approach is the same. The following technique has been developed in doing over 125 open reductions; it is not presented as anything original, but merely as the method which has been found to be satisfactory in this series.

The patient is placed flat on the operating table, with the hip to be operated upon flush with the edge of the table. This position allows perfect freedom for the operation and does away with the necessity for the use of sand-bags or other appliances to hold the child in place. The surgeon can sit with his field directly in front of him, with one assistant opposite and a second, if possible but not necessarily, at his side nearest the foot of the table. In draping the patient, the dislocated extremity must, of course, be free so that it can be manipulated easily; and the adductor region should be prepared and made easy of access.

The plan for the exposure of the hip follows the principle of ilium-stripping and muscle-splitting, devised by Sprengel and modified and popularized by Smith-Petersen. The incision, however, is a straight one and runs from the lateral edge of the ilium diagonally across the thigh to the mid-anterior line, its length varying with the size of the child (Fig. 1). When the upper skin flap is dissected free, the anterior portion of the crest of the ilium, the anterosuperior iliac spine, and the muscles and fasciae on the anterior and lateral aspects of the hip are exposed. The advantages of this straight incision are that the resulting scar will be away from the bony prominences, and also that the suturing is easier and the healing quicker, due to the better type of skin encountered as compared to that nearer the groin. Hibbs's towel clamps are used to seal the skin away from the wound and to make unnecessary the clamping and tying of superficial bleeders.

The fleshy mass of the external oblique muscle is found as a rule to be overhanging the crest of the ilium, to which it is attached, and this fold

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester Minnesota, June 7, 1934.

must be retracted upward in order to expose the crest between it and the gluteus medius and tensor fasciae latae origins. The crest, which, of course, is cartilaginous in these cases, is now cut vertically through to the underlying bone from the anterosuperior spine backward, for about six centimeters in the average case. With an elevator the lateral portion of this cartilaginous crest can then be freed from the bone, carrying with it the periosteum on the side of the ilium, which is stripped downward and backward toward the acetabulum and the head of the femur, but not separated from the tip of the anterosuperior spine. The pocket thus formed is packed with a gauze sponge to control the slight bleeding from the raw surface of the ilium, and then the line of cleavage between the tensor fasciae latae and the sartorius muscle is found by a vertical incision through the fascia distal to the anterior spine, care being taken not to cut the lateral femoral cutaneous nerve. These muscles are separated from each other and the rectus femoris, which lies directly beneath the sartorius

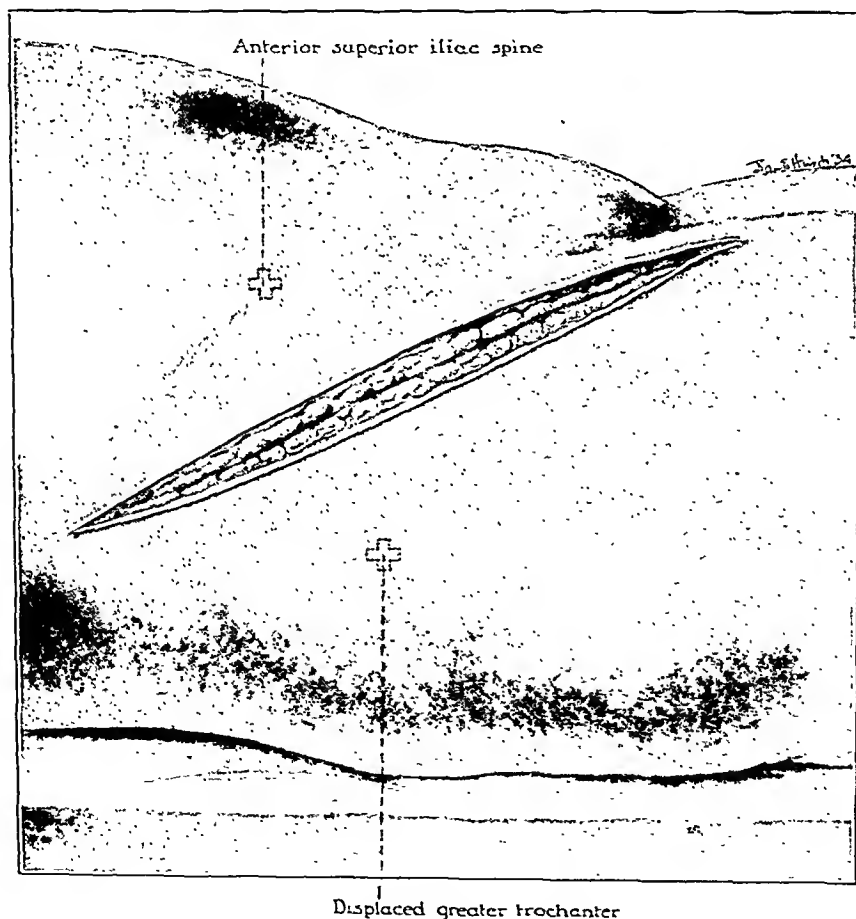


FIG. 1

at this point, is retracted medially with that muscle. In most of the cases, the branches of the lateral femoral circumflex artery and accompanying veins, which bridge this line of cleavage, must be clamped and cut across to allow better exposure. The remaining attachment of the

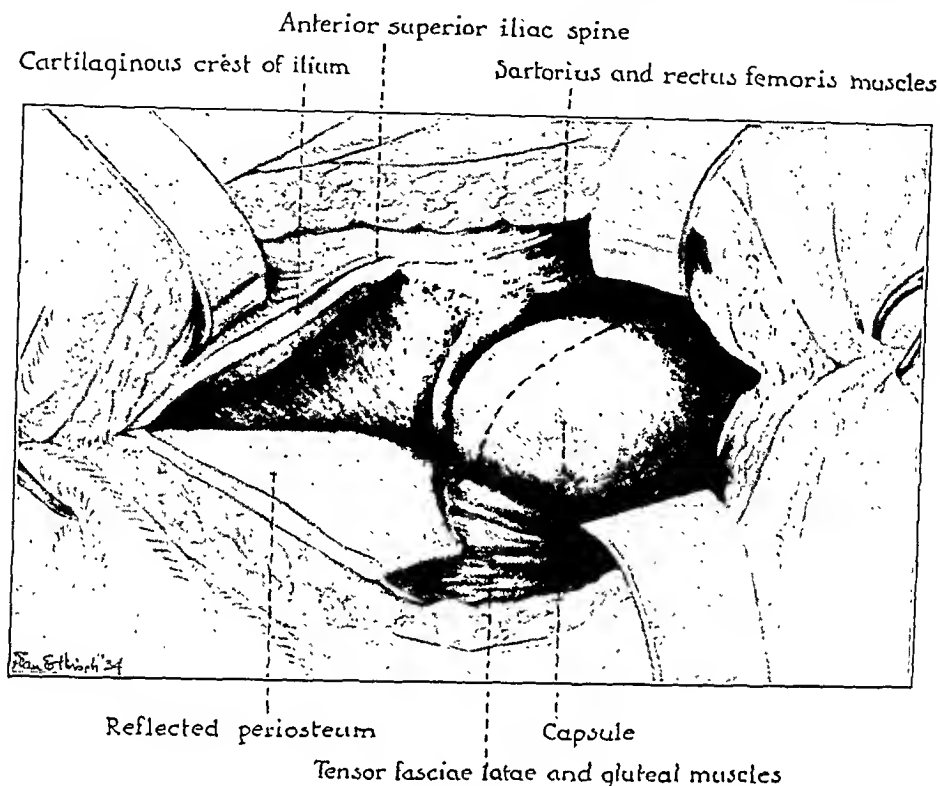


FIG. 2

tensor fasciae latae to the anterior spine is now cut and the incision carried backward, so that the two parts of the deep incision are connected, the periosteum above the acetabulum being cut through (Fig. 2). By turning down a lateral flap in this manner, one obtains an excellent exposure of the capsule overlying the dislocated head.

The capsule, which is sometimes nearly a centimeter in thickness, is now cut over the head in a line approximately parallel to the ilium, while strong traction is placed on the leg to prevent the knife from injuring the articular cartilage. The small initial incision is continued in both directions with heavy scissors until sufficient exposure is obtained and the head of the femur can be examined and the presence or absence of the ligamentum teres and the depth of the acetabulum determined. A retractor placed into the socket will allow it to be visualized (Fig. 3).

In a typical case a fold of capsule and synovial membrane will be seen partly occluding the acetabulum at its distal or lower side and it is this constriction which has been described as the "hour-glass" contracture of the capsule and which prevents reduction of the head in many cases. Its barrier is easily removed by incising it perpendicularly to its edge and the profuse bleeding which sometimes occurs following this is easily

controlled by a pack. No ligation is ever necessary, for the tension on the structures and the pressure of the head of the femur after reduction will prevent further hemorrhage.

In some cases the acetabulum has been flattened by a filling in of fibrous tissue and this tissue must be disposed of before anything else is

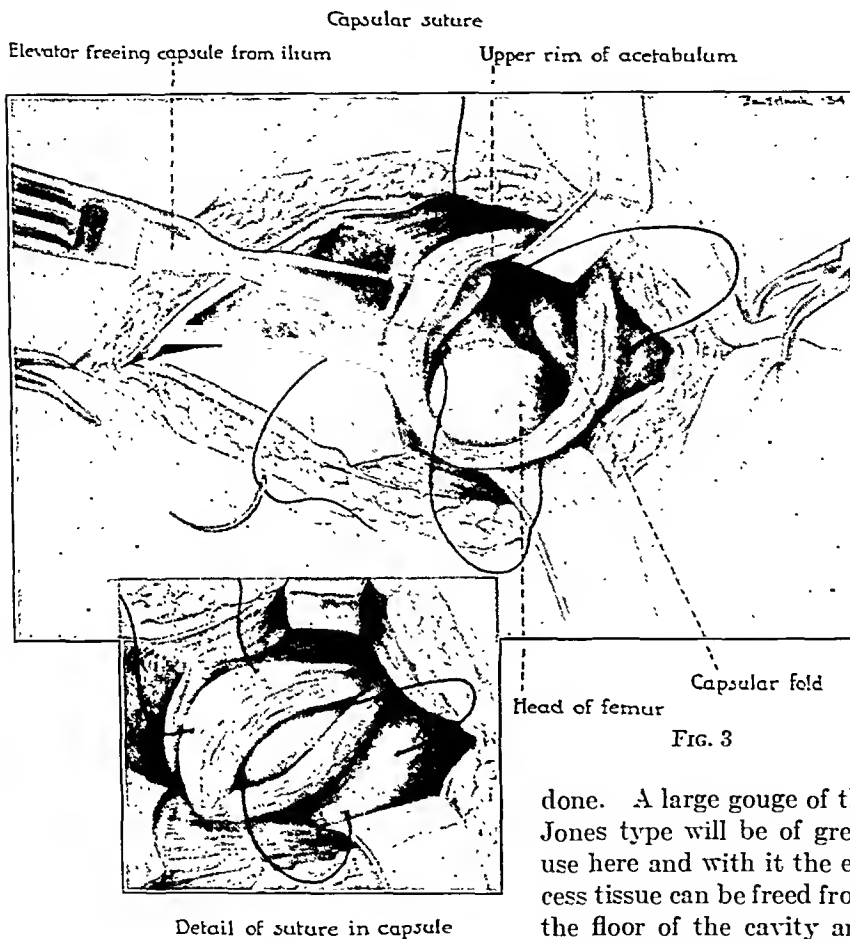


FIG. 3

done. A large gouge of the Jones type will be of great use here and with it the excess tissue can be freed from the floor of the cavity and pushed downward out of the

way, leaving room for the head directly against the articular cartilage. It is rarely necessary to remove any of this cartilaginous tissue. If the ligamentum teres is present, it is long and ribbon-like, so that by its bulk it sometimes completely fills the acetabulum as reduction is attempted. In these cases the ligamentum teres must be excised to make room for the head. In the majority of cases of congenital dislocation upon which we have operated, the ligament has disappeared and its only remnant is a fringe on the head of the femur where it was attached.

The capsule, where it is adherent to the ilium above the acetabulum, is now freed by an elevator passed behind it and lifting it and the periosteum

upon in from four to six weeks after the first, depending on the stability obtained in the joint at the first operation. On the day before the second operation the spica is bivalved, but the halves are strapped together; and then, after the child has been sent to the operating room, enough plaster is removed from around the second hip to allow surgical approach to that joint. After the wound has been closed and the dressings put in place, the bivalved plaster is completely removed and a new double spica applied.

In some patients the bony acetabulum will be found to be so shallow that it must be deepened in order to prevent redislocation; this may be done by turning down the upper border with a gouge or osteotome and placing above it a buttress of bone removed from the crest of the ilium. By pushing the remaining portion of the cartilaginous crest medialward but leaving the anterosuperior spine in place, this detached portion will carry with it the periosteum on the inner side of the ilium, and a graft can be removed which is ideally shaped for this purpose. If the graft is well fitted, it will remain in place above the lowered acetabular rim without any difficulty.

Deepening of the acetabulum by cutting away its floor is sometimes done, but the results are not as satisfactory as with the shelving operation and a stiffened hip is more likely to occur.

A roentgenogram should be taken through the plaster to check up on the position of the head as soon as possible after the open reduction. In rare cases redislocation may have taken place, due to faulty technique or other factors and, if this is discovered, it should be remedied quickly. If the wound can be opened again within a few days, the procedure is not difficult; but after this the formation of scar tissue and adhesions makes it progressively harder.

The after-treatment of open reductions is not definitely within the scope of the title assigned to me, but must be mentioned. The position in the plaster dressings is awkward, but some of the children are able to start early weight-bearing in spite of this. In others a new plaster can be applied after four to six weeks with the abduction reduced, so that the child can become ambulatory. Most patients, however, do not move around very much during the period of fixation. This period varies from two to four months, depending on the character of the reduction and the anatomy of the parts. Both shorter and longer times have been used.

After the plaster dressing has been removed, the child's body is fastened to a gas-pipe frame, preventing too much activity but allowing the legs to be kicked about freely. In a few of our cases, when this precaution was not taken, supracondylar compression fractures of the femur resulted on account of the atrophy present. Physiotherapy and the swimming tank are used after a week or ten days, but weight-bearing is not allowed for from three to four weeks except in the tank. After this, however, all activities are encouraged.

# COMPARATIVE ANALYSIS OF THE RESULTS OF OPEN AND CLOSED REDUCTIONS IN CONGENITAL DISLOCATION OF THE HIP \*

BY FREDERICK C. KIDNER, M.D., DETROIT, MICHIGAN

*From the Orthopaedic Clinic, Children's Hospital of Michigan*

The object of this paper is to make an accurate analysis of the results of twenty-six cases in which thirty-four congenital dislocations of the hip were reduced by open operation, and to compare these results with thirteen cases in which twenty-two dislocations were reduced by the closed method. All but three of the open operations were done by the method advocated by the author in 1932. This method is applicable to children between the ages of eighteen months and ten to twelve years in whom closed reduction can be accomplished only by the use of force and, when following such reduction, the hip is not perfectly stable.

The method consists essentially of a vertical incision from the antero-superior spine downward just outside the sartorius, passing to the inner side of the rectus which is preserved intact, if possible. If not, its tendon is cut and later sutured. The hip joint is approached from above and the psoas is retracted inward. The capsule is identified and its adhesions to the side of the pelvis are separated by blunt dissection. These adhesions are found in the great majority of cases and are the most important obstacle to reduction. This separation allows the head to be pulled downward by direct manual traction until it is opposite the acetabulum. In a few older cases, traction does not accomplish this because of shortening of the fascia. Rarely does shortening of the muscles prevent the descent of the head. Occasionally, in the older patients especially, the short rotators do prevent the descent of the head. When the capsule has been freed from the side of the pelvis, it is opened, preferably in the long axis of the fibers, but the form of opening is dependent on the thickness and shape of the capsule.

Exploration of the inside of the joint usually reveals several features which present difficulties in reduction. The first and most important of these is the complete closure of the mouth of the true acetabulum by the stretching upward of the lower leaf of the capsule. This has been described in detail in a previous article.<sup>1</sup> Its presence completely blocks the entrance of the head into the acetabulum. Complete section of this lower leaf is always necessary and can be done under direct view. This obstruction corresponds to what has always previously been described as the hour-glass contraction. The author has never seen any resemblance whatsoever to an hour-glass appearance. The narrowing of the entrance

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to the true acetabulum is formed by the portion of the capsule which is attached to the lower edge of the acetabulum and which, because of the dislocation, is stretched tightly upward across the mouth of the acetabulum. When the joint is examined from above, a crescentic edge of capsule appears which might be mistaken for an hour-glass contraction. The second difficulty encountered is a redundant and enlarged round ligament, which is frequently big enough to fill the whole cavity of the acetabulum when folded into it, leaving no room for the head. In the older cases the round ligament may be tenuous or absent, but it has been the author's experience that age does not with any regularity determine the condition of this ligament. The third difficulty is the relative difference in size between the acetabulum and the head. In the great majority of cases, when the lower leaf of the capsule has been cut away, it is found that the acetabulum is perfectly competent to admit the larger part of the hemisphere of the head. The fourth difficulty is the presence of an acetabulum with a sloping roof. Several of the author's failures to obtain reduction have been due to the fact that, although the sloping surface was recognized, no steps were taken to overcome it, such as the immediate use of a shelf. The fifth difficulty lies in the fact that occasionally the anteversion of the neck is so great and the neck is so short that, although the acetabulum is sufficiently deep, the head of the femur cannot be thrust sufficiently far into it because the lesser trochanter or the greater trochanter comes in contact with the edges of the acetabulum.

These difficulties are met as follows: The lower leaf of the capsule which obstructs the opening is widely split. The second difficulty is eliminated by the removal of the redundant round ligament. The third difficulty, insufficient size of the acetabulum, occasionally has to be met by curettage of the cartilage. Rarely is it necessary to attack the bone. When the bone has to be reshaped, it has been the writer's experience that permanent limitation of motion results. The solution of the problem of the sloping roof of the acetabulum is the immediate formation of a small shelf by the insertion of a thin osteotome one-quarter of an inch above the attachment of the superior leaf of the capsule. The roof is then pried downward, carrying with it the upper leaf of the capsule, the cartilage of the oblique roof, and a very thin slice of bone. When this is done, suture of the capsule after reduction will hold this wedge of bone downward without the insertion of any form of bone graft. The fifth difficulty, the short anteverted neck and flattened head, may be met by securing the best possible reduction and then maintaining it in the most favorable position for a long period of time.

In the thirty-four open reductions here analyzed all of these difficulties were experienced. Any one of the hips, when examined at the time of operation, seemed to provide sufficient obstruction to interfere seriously with a successful closed reduction on that particular hip. The thirty-four hips in which dislocation was reduced by the open method and the twenty-two in which reduction was effected by the closed method

TABLE I  
NUMERICAL ANALYSIS †

Case No.	Male	Female	Age at Operation (Years)	Present Age (Years)	Right Hip	Left Hip	Both Hips	Open Method	Closed Method	Recurrences		Results				
										Open	Closed	Excellent	Good	Fair	Poor	Bad
1		1	10	14		1		1		1						1
2		1	7	10	1			1		0			1			
3	1		9	13			1			0			1	1		
4	1		2**	7½	1			1	1	1	1	1**			1*	
5		1	6**	5			1	2		1			2			
6	1		4	7½	1			1		0		1				
7		1	5	11		1		1		0		1				
8		1	5½	13½			1	2	2	0	2				2**	2*
9		1	8½	14	1			1		0		1				
10		1	4	7		1		1		1		1				
11		1	4	8		1		1		1			1			
12		1	2	5		1		1		1		1				
13		1	5½	7	1			1		0				1		
14		1	9	10½		1		1		0			1			
15		1	8½	11		1		1		0		1				
16		1	3½	6½		1		1		0		1				
17		1	7	13		1		1		0			1			
18		1	6	10			1	2		0			2			
19	1		5½	8			1	2		0			2			
20		1	11½	3½	1			1	1	1	1	1**			1*	
21		1	10½	13½		1		1		0					1	
22	1		2½	5½		1		1	1	1	1	1**			1*	
23		1	5	10½		1	1	2		0		1			1	
24		1	7	13½		1		1		0					1	
25		1	7	10	1			1		1		1				
26		1	2	7			1	2		0		2				
29		1	15½	9		1			1		0		1			
30		1	15½	11		1			1	0		1				
31		1	2½	11½		1			1	0			1			
32		1	2½	11			1	2		1			2			
33		1	5	17		1		1		1					1	
34		1	2½	12		1			1	0			1			
35		1	3	11			1	2		2					2	
36		1	1½	6		1		1		1				1		
37		1	2	10			1	2		1				1	1	
38		1	2½	9			1	2		0		1				1
39		1	3	4½	1			1		1					1	
40		1	2½	6			1	1		0		2				
41		1	1½	3		1		1		0						1
Total	5	34			8	19	12	34	22	9	12	18	16	4	13	5

† In Cases 27 and 28 the patients have been operated on too recently to include the results.

\* Closed reduction.

\*\* Open reduction.

have all been examined and x-rayed in detail by the author within the last four months. Fifty other hips—in forty of which reduction was by the open method and in ten by the closed method—have not been included in this series because it has been impossible to get the patients to come in.

for a follow-up examination. The last hospital notes on these cases are either too old or too vague to justify their inclusion.

In almost every case in which operation was unsuccessful the bad results can be traced to errors of judgment. For instance, in Case 1, in which the patient was operated on at the age of ten years, reduction should never have been attempted, but a shelf should have been constructed for stabilization. Misguided attempts at reduction led to fracture of the neck of the femur, failure of reduction, and a stiff, flexed, externally rotated hip, four inches shorter than the other. In Case 2, although an excellent functional result was obtained—one-half an inch of shortening, no limitation of motion or Trendelenburg symptom, and only a slight limp—the result is not perfect because the slanting character of the acetabular roof was not recognized at the time of operation. In Case 3, in which bilateral dislocation of the hip in a boy of nine was reduced by the open method, there is now flexion of 20 degrees in the left hip and a range of motion of only about 20 degrees, because the acetabulum was completely reamed out in a misguided attempt to secure stable reduction. The other hip has two-thirds of normal motion because the small wedge of bone previously described was turned down. In Case 8, in which several attempts to reduce the double dislocation by the closed method had been made previously by other men, the fact should have been recognized at operation that there had been so much trauma to the heads that open reduction was not indicated. Shelves should have been made on each side.

Recurrences in the cases treated by open operation—as in Case 20, a child of sixteen months—were usually due to overconfidence in the solidity of the reduction. Most of these hips, after open reduction, seem very firm, and the range of motion possible without redislocation is extraordinarily large. In some of his cases the author put too much faith in this apparent stability and immobilized the hips in plaster in too nearly the normal position without enough abduction. There were recurrences in these cases. There has been only one recurrence as the result of too short a period of fixation in plaster, although in a few cases the patients were immobilized in plaster for as short a time as six weeks. This practice the writer feels to be unwise and the period of fixation is now about three months.

In the closed reductions, it is of course impossible to attribute with any degree of scientific accuracy the recurrences and failures to any one of the five difficulties just described. It is, however, worth while to speculate a little on some of the probable happenings. For instance, in Case 29, in which a dislocation of the left hip was reduced by the closed method at the age of seventeen months, the x-ray before reduction showed a very badly deformed femoral epiphysis. The reduction was easy, although the acetabulum felt very shallow and in the x-ray appeared to have a very oblique roof. Ten months in plaster resulted in a fairly stable hip, but with a badly deformed acetabulum which enclosed only half of the mush-

room shaped head. In this case reduction probably never was complete. In Case 35, that of a three-year-old child, reduction was easily effected in both hips, but they felt unstable. Recurrences took place two or three times in both hips and sixteen months in plaster was necessary to secure stability. Probably in both of these hips the lower leaf of the capsule completely blocked the acetabulum, forming a cushion between the head and the acetabulum which only long fixation finally caused to atrophy. The result in this case is a useful pair of hips, but marked lumbar lordosis. In Case 37, that of a child of two years, reduction in both hips was brought about by the closed method, but both were unstable and required long fixation in plaster. These hips now show irregular heads and only partly competent acetabula, which suggest the probability of subsequent weakness, pain, and arthritis.

TABLE II  
SUMMARY OF END RESULTS

End Result	Unilateral Dislocation					
	Open Reduction			Closed Reduction		
	Cases	Hips	Per Cent.	Cases	Hips	Per Cent.
Excellent.....		15	44.12		3	13.64
Good.....		11	32.36		5	22.73
Fair.....		2	5.88		2	9.09
Poor.....		3	8.82		8	36.36
Bad.....		3	8.82		4	18.18
Total.....	26	34	100.00	17	22	100.00

End Result	Bilateral Dislocation					
	Open Reduction			Closed Reduction		
	Cases	Hips	Per Cent.	Cases	Hips	Per Cent.
Excellent.....		3	21.43		1	10.00
Good.....		7	50.00		4	40.00
Fair.....		1	7.14		1	10.00
Poor.....		1	7.14		3	30.00
Bad.....		2	14.29		1	10.00
Total.....	7	14	100.00	5	10	100.00

In view of the many changes and obstructions found at open operation, it is difficult for the author to believe that a really firm reduction by the closed method can be obtained in any considerable percentage of cases. To his way of thinking, practically all such reductions must be unstable and dependent for their ultimate success on adaptation of contours and atrophy of obstructing soft parts through long fixation. In the very young children, this undeniably takes place frequently with good results.

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Increase in the nominal age, or in real age as demonstrated by growth, must make these adaptations and atrophies harder to accomplish. Except in the cases where reduction is easy, the trauma to the soft parts, the head,

TABLE III  
AGE INCIDENCE

	Case No.	Hips Involved	Age at Operation (Years)	Present Age (Years)	Results
<i>Open Reduction</i>					
	1	One	10	14	Bad (fracture)
	2	One	7	10	Good
	3	Both	9	13	Left, fair; right, good
	4	One	6	7½	Excellent
	5	Both	5	7	Left, good; right, good
	6	One	4	7½	Excellent
	7	One	5	11	Excellent
	8	Both	5½	13½	Left, bad; right, bad
	9	One	8½	14	Excellent
	10	One	4	7	Excellent
	11	One	4	8	Good
	12	One	2	5	Excellent
	13	One	5½	7	Fair
	14	One	9	10½	Good (shelf)
	15	One	8½	11	Excellent
	16	One	3½	6½	Excellent
	17	One	7	13	Good (two attempts)
	18	Both	6	10	Left, good; right, good
	19	Both	5½	8	Left, good; right, good
	20	One	1½	3½	Excellent
	21	One	10½	13½	Poor (bone curettement)
	22	One	2½	5½	Excellent
	23	Both	5	10½	Left, excellent; right, poor (sepsis)
	24	One	7	13½	Poor (bone curettement)
	25	One	7	10	Excellent
	26	Both	2	7	Left, excellent; right, excellent
<i>Closed Reduction</i>					
	29	One	15½	9	Good
	30	One	1½	11	Excellent
	31	One	2½	11½	Good
	32	Both	2½	11	Good
	33	One	5	17	Poor
	34	One	2½	12	Good
	35	Both	3	11	Poor
	36	One	1½	6	Fair
	37	Both	2	10	Right, fair; left, poor
	38	Both	2½	9	Right, excellent; left, Legg-Perthes disease
	39	One	3	4½	Poor
<i>Summary</i>					
			Open Reduction	Closed Reduction	
			Age at Operation (Years)	Age at Operation (Years)	Present Age (Years)
Average age			5¾	2¾	10½
Youngest			1½	1½	4½
Oldest			10½	5	17

TABLE IV  
TIME IN PLASTER \*

Case No.	Period	Remarks
<i>Open Method</i>		
1	Not known	
2	6 weeks	Too short, as upper edge of acetabulum gave way somewhat, but very good result.
3	4 months	Both sides.
4	3½ months	
5	Left, 4 months; right, 3 months	
6	2 months	
7	5 months	
8	3 months	Patient immobilized in plaster for long periods after attempts at closed reduction and for three months after open reduction. Shelf operation should have been performed.
9	2 months	
10	4 months	
11	3½ months	
12	4 months	
13	3 months	
14	4 months	
15	2 months	
16	4 months	
17	4 months	
18	4 months	
19	4 months	
20	3 months	
21	6 weeks	Acetabulum dug out to bone. Good motion never obtained.
22	6 months	Including recurrence.
23	Left, 2 months; right ?	Right hip—shelf; scarlet fever, infection, many months.
24	?	Acetabulum dug out.
25	3 months	Gradual recurrence.
26	6 months	
<i>Closed Method</i>		
29	10 months	
30	8 months	
31	6 months	
32	12 months	
33	9 months	
34	6 months	
35	16 months	
36	6 months	
37	10 months	
38	8 months	Legg-Perthes disease one year after reduction.
39	6 months	Gradual recurrences.
<i>Combined Method</i>		
40	7 months	
	Right, closed	
	Left, open	
41	4½ months	Recurrence twice after closed reduction.
	after open reduction	

\* Average Time in Plaster:

Open method—3½ months

Closed method—7½ months



TABLE V  
X-RAY APPEARANCE AFTER OPEN REDUCTION

Case No.	Age	Head	Acetabulum
1	14	Flat	Unchanged
2	10	Good	Shallow roof
3	13	Left: irregular, cartilage thin	Left: irregular, competent
		Right: good	Right: excellent
4	7½	Good, anteverted	Roof developing
5	7	Left: good, high	Left: sloping roof
		Right: good	Right: completely competent
6	7½	Good, but high	Shelf makes excellent roof
7	11	Somewhat flat	Three-fifths competent
8	13½	Left: badly deformed	Left: incompetent
		Right: badly deformed	Right: incompetent
9	14	Slightly flat	Roof competent
10	7	Somewhat flat	Two-thirds competent
11	8	Slightly flat	Irregular; one-half competent
12	5	Slightly flat	Fully competent
13	7	Fair development	Competent
14	10½	Slightly wide	Competent (shelf)
15	11	Somewhat flat	Roof competent
16	6½	Good	Slightly large; competent
17	13	Slightly flat	Perfect fit
18	10	Left: good	Left: excellent
		Right: good, slightly high	Right: slightly sloping roof
19	8	Left: good	Left: competent
		Right: flat	Right: good (shelf)
20	4	Slightly flat	Roof competent, but slopes 15 degrees more than other
21	13½	Flat	Competent; cartilage destroyed; stiff
22	5½	Slightly high	Roof four-fifths competent
23	10½	Left: good	Left: three-fifths competent
		Right: in place, cartilage destroyed	Right: Competent; no cartilage; sepsis
24	13½	Flat	Flat
25	10	Good	Competent
26	7	Left: slightly flat	Left: four-fifths competent; slightly flat
		Right: normal	Right: normal

and the acetabulum incident to closed reduction must, because of the force used, be greater than in open operation.

For the reasons stated, the author is still convinced that, even in very young children, open operation is the better method, unless reduction by the closed method can be obtained with a minimum of force and unless immediately following this reduction the hip is stable. In seventy-three cases in which open reduction was done, there has been one death from acidosis; this diagnosis was confirmed by the pediatricians. This case has been previously reported and it is highly probable that the poor condition of the child would have led to serious results no matter what form of reduction was carried out. One case of sepsis of a very virulent character occurred in the right hip of a patient with a bilateral dislocation (Case 23). After several attempts at closed reduction had been made, reduction in the left hip was successfully accomplished by the open method; the right

TABLE VI  
X-RAY APPEARANCE AFTER CLOSED REDUCTION

Case No.	Age	Head	Acetabulum
29	9	Mushroom	One-half competent. Irregular
30	11	Normal	Normal
31	11½	Slightly flat and high	One-half inch higher; four-fifths competent
32	11	Left: approaches normal Right: neck short	Left: approaches normal Right: irregular; three-fifths competent
33	17	Mushroom; one-half inch higher	Wandering type
34	12	Good, slightly high	Sloping roof
35	11	Left: head small, neck short Right: head small, neck short	Left: high and sloping Right: high and sloping
36	6	Flat	Large, irregular, sloping
37	10	Left: fairly good Right: high	Left: fairly good Right: one-fourth competent
38	9	Left: Legg-Perthes disease Right: nearly normal	Left: nearly normal Right: nearly normal
39	4½	Head anteverted, short neck	Large, sloping, incompetent
40	6	Left: slightly large, high Right: nearly normal	Left: competent; slightly sloping Right: nearly normal; competent
41	3	Good, neck short	Very large, but competent

hip required a shelf operation. Scarlet fever developed the day after operation; the diagnosis was again confirmed by the pediatrician. There have been no other untoward results. These forty-five cases included sixty hips.

The accompanying tables are as nearly accurate and unbiased as it is possible to make them and show the essential details of each case. In recording the results obtained either by open reduction or by the closed method, there has been no selection of cases. The cases reported include all the patients who have come back for examination during the past four months in response to letters or personal visits. In these tables results are shown as excellent, good, fair, poor, and bad. Excellent means a perfect clinical result without a limp, Trendelenburg sign, disability, loss of motion, shortening, or atrophy and an x-ray in which the changes shown are insignificant. Good means an excellent clinical result without disability, but with a slight limp, Trendelenburg sign, shortening, or slight limitation of motion, and significant roentgenographic changes. Fair is a little worse than good. Poor represents a considerable handicap. Bad means failure.

A careful study of the analysis of the material provided by this small number of congenital dislocations demonstrates that:

1. The results of closed reduction, even in very young children, are often unsatisfactory, although the only perfect end result from the clinical and roentgenographic standpoints falls in this group.
2. Force should never be used to obtain reduction.
3. Except in rare cases, the anatomical changes inherent in congenital

TABLE VII  
RECURRENCES

	Case No.	Age (Years)	Description
<i>Open Reduction</i> †			
	1	10	Dislocation never reduced. Head still out. (Fracture.)
	4	6	Recurrence. Replaced by closed reduction.
	5	5	Recurrence in left hip while patient was on table being placed in plaster.
	10	4	Recurrence three months later because of too great confidence in procedure.
	11	4	Recurrence two weeks after operation while the patient was in plaster, due to too great confidence in procedure.
	12	2	Recurrence in two weeks because of too great confidence in procedure.
	20	1½	Recurrence in four weeks because of too great confidence in procedure.
	22	2	Recurrence in two months because of unwillingness to curet the insufficient acetabulum. Secondary closed reduction successful.
	25	7	Recurrence in nine months because of unwillingness to curet acetabulum. Should have had shelf operation.
<i>Closed Reduction</i> * #			
	4	2	Recurrence in two years.
	8	5½	Three recurrences followed by unsuccessful open reduction.
	22	2½	Recurrence.
	32	2½	Recurrence in right hip.
	33	5	Gradual recurrence because of badly shaped acetabulum.
	35	3	Two recurrences on each side, necessitating sixteen months in plaster.
	36	1½	Subluxation because of bad shape of acetabulum.
	37	2	Subluxation on right; shortening of three-quarters of an inch.
	39	3	Subluxation, gradual sliding up.

† Number of recurrences after open reduction—9.

\* Total number of recurrences after closed reduction—12.

# Number of recurrences after closed reduction only—7.

dislocation require open surgical treatment if reduction is to be intelligently performed and permanently satisfactory.

4. The results of open reduction are better than those of closed.

5. Open reduction is not dangerous.

6. A small incision, which does little damage to soft parts or muscle attachments, is sufficient.

7. Adhesion of the capsule to the side of the ilium is the major factor in preventing reduction, and actual muscle contraction, except in the older cases, does not interfere with reduction.

8. The period of immobilization in plaster is much shorter after open reduction than after the closed method.

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## OPEN REDUCTION IN CONGENITAL DISLOCATION OF THE HIP \*

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The results of the treatment by closed manipulation of the 336 hips with congenital dislocation, seen at the New York Orthopaedic Hospital from October 1900 to October 1920, and sufficiently followed, have already been reported.<sup>1</sup> Reduction was secured and maintained in 41 per cent. of these hips.

In the following ten years, 156 additional hips have been treated by closed manipulation and good reduction has been maintained in 44 per cent. for an average follow-up period of eight years and a minimum of two years. Open reductions of forty-three of these latter hips were subsequently performed. Thus the percentage of successful reduction by closed manipulation of 492 hips with congenital dislocation has been 42.

The results of all cases of this condition treated by open reduction to July 1929 have also been reported.<sup>2</sup> Good reduction was maintained in 61 per cent. of the seventy-two hips in the group. Subluxation occurred in 31 per cent. and redislocation in 8 per cent. During the following three and one-half years, fifty additional open reductions were performed, and the results for the forty-nine hips followed for at least one year are reported herewith. During the period covered by these 122 open reductions, forty-two shelf-stabilization operations without reduction have been performed for congenital dislocation of the hip, but none of the patients was younger than eight years and only six were under ten years of age. An open reduction combined with a shelf-stabilization operation was done in sixteen instances in this period.

### CLINICAL AND ROENTGENOGRAPHIC FEATURES †

The ages of the children in the last group of forty-nine open reductions varied between nine months and eight years, the average being three and six-tenths years. Twenty-three were under three years, twenty were between three and five years, and six were from six to eight years old. Significant limitation of motion was present before operation in only seven instances. Ten patients had bilateral open reductions, there being thirty-nine patients in the group. All but nine of the dislocations were anterosuperior, these nine being posterior and high on the ilium. It seems likely that the posterior dislocation is simply the ultimate result of a

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester, Minnesota, June 7, 1934.

† Observations and discussions which are of minor importance and which are essentially similar to those in the report of the previous series will not be repeated here.

primary anterosuperior dislocation in which the capsule has become greatly elongated, allowing the head to rise upward and swing backward on the ilium. Four femora were merely subluxated, ten were opposite the upper margin of the acetabulum, and twenty-four were dislocated onto the ilium. Telescoping varied between one-quarter of an inch and one inch, averaging one-half an inch, as measured in comparative roentgenograms, taken with the patient standing and with the application of manual traction. There was no important difference in the amount of telescoping in the three age groups.

Closed reduction of thirteen of these hips was attempted. The length of the period before open reduction was resorted to varied between a few days and two years; the average was seven months. Four patients had had manipulations at other hospitals. All were children under three years of age. Eight of the thirteen hips were left in plaster several months; five seemed hopeless at the outset. It was obvious at open operation in nearly all of these hips that the femoral head could not be passed through the constriction of the capsule, and the ligamentum teres was large enough to interfere with the reduction in several cases. The ligamentum teres was found to be ruptured in one instance and absent in seven. Four of the acetabula were too small or too shallow to admit the head. One acetabulum was completely lined with dense fibrous tissue.

#### THE OPERATION

Preliminary traction with adhesive tape and the Taylor splint, or Thornton well-leg spica apparatus, was used for seven hips. Only two of these patients were younger than six years. The traction was usually employed for about a month, and resulted in pulling the head down one-quarter of an inch to one inch, little more than the descent seen in the roentgenogram on simple manual traction. No skeletal traction was used. Reduction was quite difficult in four of these seven hips in spite of the use of traction.

The Smith-Petersen approach was used. The inferior portion of the capsule was pulled up over the lower acetabulum and had to be divided inferiorly in nearly all of the hips to permit reduction of the head. The capsule and labrum glenoidale were cut superiorly in only seven cases. The ligamentum teres was always removed when present. Adductor tenotomies were necessary on six occasions; in one of these cases the rectus tendon was lengthened, and in two others the sartorius muscle, psoas sheath, and iliotibial band were also divided. A crescent of the capsule was excised anterosuperiorly in fourteen hips to remove the pocket into which the femoral head might redislocate.

The acetabulum was not altered in eleven of the hips, except that the pad of fibrofatty tissue in the inferior portion was removed. In twenty-six hips, the cartilaginous roof of the acetabulum was reshaped because of its obliquity, irregularity, or small size. The acetabulum was enlarged upward into the ilium by removing some of the bone of the roof in five

instances, because the dislocation of the femur could not otherwise be reduced. A shelf was built over the femoral head at the superior acetabular margin in seven hips; four of these hips were also gouged. A large lip at the inferior margin of two of the heads was excised.

#### PATHOLOGY

The acetabulum was usually somewhat shallow and its roof oblique. It contained a mass of fibrofatty tissue large enough in several instances to prevent reduction. The ligamentum teres was absent in sixteen cases, ruptured in three, and split in two. Free bleeding occurred only once upon excising this ligament; slight bleeding occurred eleven times. No abnormality of the head was found at operation or subsequently, which could be ascribed to the absence or removal of the ligamentum teres. The superior portion of the capsule was adherent to the ilium in several instances, and was freed to permit it to resume its normal relation to the head on reduction. There was rarely found any appreciable relaxation on pulling the femur laterally or backward and forward at the hip in the anterior dislocations, but often as much as an inch of such motion was perceptible in the posterior dislocations. The femoral head was usually flattened medially, and in one instance there was degeneration of the cartilage at the crest.

#### OTHER OPERATIONS

On only one hip were two open operations performed; this hip re-dislocated and another open reduction with a shelf stabilization was done. Only one manipulation for better socketing was necessary. Osteotomy for anteversion was done on twenty-three femora, eleven of which were in children under three years of age. The anteversion, in these eleven cases, as determined at open reduction, averaged 63 degrees, the minimum being 45 degrees. Good correction was obtained in all but one case. The anteversion averaged 50 degrees in the remaining cases.

#### COURSE

There were no deaths or infections. Plaster-of-Paris hip spicas were applied just after operation in all cases, usually with the hip in extension, abduction of 15 to 30 degrees, and internal rotation of about 30 degrees. The spicas were worn from four weeks to five months. In only five cases were the spicas worn more than three months, the average time being two and one-half months. The longer periods were usually associated with an osteotomy for anteversion. On several occasions where stiffness was feared, the anterior leg portion of the spica was removed within two or three weeks after the operation and daily motion was begun. In eleven cases the spica was removed early and a double long-leg cast, with cross-bars to maintain abduction and internal rotation, was applied for early limited motion. In two cases, traction was used postoperatively with the Thornton apparatus for relief of tension, with

encouraging results. Active motion was begun promptly upon removal of the plaster, but weight-bearing was usually delayed from one to three weeks, until motion and muscular control of the limb were regained. When there was any tendency to subluxation, as best shown in roentgenograms taken with the patient standing and with traction applied, weight-bearing was delayed and occasionally a spica was applied for a longer period. Any tendency to subluxation asserted itself shortly after removal of the spica, and, in most instances, gradually disappeared.

Good motion was regained in a period varying between two and twenty-four months after operation; the average time required was nine months. The hips of patients under three years regained good motion in an average of six months, those of the older patients in twelve months. Ten hips with fair motion one year after operation had good motion within the following year. Hips in which tension due to soft-tissue contractures was present after reduction, those in which the labrum glenoidale was cut, and those with badly deformed femoral heads remained stiff longer. Simple gouging of cartilage, even when a small area of cortical bone was exposed, did not prolong the period of stiffness.

#### RESULTS

The follow-up period varied between one year and four years, averaging two and one-half years. The standards used are the same as for the previous study of open reductions. Redislocation occurred in one hip of a boy of four years and was subsequently corrected by open reduction and shelf stabilization. Subluxation of his other hip followed open reduction with gouging. Subluxation also occurred in both of the deformed hips of a feeble-minded girl of two and one-half years with multiple congenital deformities and poorly developed musculature of the lower extremities, and in two other hips. In all of the remaining hips (90 per cent.) the dislocation remained well reduced as shown in roentgenograms taken with the patient standing and with traction.

The five hips in which the acetabulum was enlarged upward by removing bone all became nearly ankylosed, with less than 30 degrees of motion in any direction, and the patients complained of pain, a limp, stiffness, and disability. The symptomatic and functional results in nearly all of the other hips were excellent. Three patients admitted slight fatigue in the hip on much activity, two noticed limitation of motion, and one noticed disability when taking part in athletics. Motion was limited slightly in six instances, the index of motion <sup>2</sup> varying from 70 to 80, and moderately in seven hips, with the index varying from 50 to 65. Normal motion was present in the remaining thirty-one hips. Residual anteversion of more than 30 degrees was found in seven hips. Clinical telescoping corresponded to that found roentgenographically and was present only in the four hips in which subluxation occurred. Shortening of one-half an inch was present in four extremities and of one-quarter of an inch in four;

lengthening occurred in two cases, apparently due to stimulation of the capital epiphysis by a circulatory disturbance.

#### COXA PLANA

Coxa plana occurred in three of the five hips in which the acetabulum was enlarged upward, the dislocation in these hips being reduced under much tension. It was present in one case before open operation, but following a closed manipulation with immobilization, and in one other case in the series. This unusually low incidence of coxa plana is explained by the fact that in most of these hips reduction was effected without tension or traumatism to the soft tissues and the hips were immobilized without tension. It is believed that the development of coxa plana in these five hips was due to an ischaemia of the soft tissues about the femoral neck, caused by a disturbance of the circulation to the capital epiphysis brought about by tension.<sup>3</sup>

#### OPERATIVE INDICATIONS

The ideal treatment of congenital dislocation of the hip is to secure the earliest possible reduction with the least possible trauma, and immobilization just long enough to result in permanent maintenance of the reduction. Such treatment should involve the least justifiable risk to the life of the patient from the anaesthetic and from shock, and the minimum risk of infection. Simple open or closed reduction with immobilization would be insufficient to maintain the reduction of some hips because of the deformity of the femoral head or the acetabulum, or the relaxation of the capsule; therefore it is necessary to correct these abnormalities in order to secure a good result. In other cases it is impossible to reduce the dislocation without unreasonable trauma or division of tissues, followed by stiffness or weakness. The best alternative in such cases is the construction of a bony support for the femoral head in the dislocated position.

A closed reduction is the operation of choice in infants younger than one year. There is a fair chance of success with a closed manipulation in children between one and three years of age. Accordingly, in this age period, a single gentle manipulation may first be attempted when it is not obvious that such a procedure would be hopeless. However, when the surgeon is familiar with the open operation and can perform it gently and safely, it is undoubtedly the surer and safer method of reduction, and permits a much shorter period of immobilization afterward. With increasing age the relative chance of failure of closed reduction becomes greater, and the open operation is the treatment of choice for the surgeon who is in a position to perform it satisfactorily. Shelf stabilization without reduction is usually preferable in children past the age of six years, particularly if the dislocation is bilateral, because of the difficulty of reduction and the probability of resultant stiffness.

Open operation should be performed with the utmost gentleness and the smallest reasonable amount of dissection. To effect reduction, it is



usually necessary to divide the inferior capsular constriction and, sometimes, the transverse ligament. The capsule should never be cut superiorly as its support may be lost and the cartilaginous lip of the acetabulum and the labrum glenoidale may be damaged. The femoral head may then be brought into the acetabulum by traction, abduction, and internal rotation. Usually it is found that the dislocation of the head cannot be entirely reduced because of the large mass of the redundant ligamentum teres and the enlarged haversian gland. These structures are, therefore, usually excised. The acetabulum may still be too small to hold the femoral head. The acetabular roof may then be enlarged and rounded by gouging if the cartilage is sufficiently thick to allow this without exposing much bone. When it has been necessary to gouge a new socket out of bone, the hip almost always has become moderately stiff. Possibly this outcome could be avoided if the new socket were made sufficiently large and lined with fascia and if the reduction were maintained without tension, but this has not been done. The results with the shelf operation, particularly in the cases of bilateral dislocation, have been so much better than those in which a large area of bone was exposed in the acetabulum that the former method is preferred. Occasionally the overgrowth of the cartilage of the head inferiorly is so great that reduction is obstructed. Some of this mass of cartilage may be trimmed away without resultant stiffness if bone is not exposed.

When the capsule is adherent, it should be freed from the ilium superiorly. The rectus tendon, labrum glenoidale, and the superior cartilaginous lip of the acetabulum should be freed when they are everted and allowed to come down to their normal levels. It is often impossible to bring the femoral head down to the level of the acetabulum without dividing some of the extrinsic resisting structures. The adductor tenotomy should be done first. It may be necessary to lengthen the iliopsoas, rectus and sartorius tendons, and the iliotibial band. If, after lengthening these structures, it appears that the hip could not be reduced, the danger to the nerves and the circulation of the joint and the extremity and the possibility of subsequent stiffness do not justify further attempts at reduction, particularly in view of the favorable results of the shelf operation and the lack of such disability in older patients who have had no treatment whatever. Similarly there seems to be no justification for such procedures as the Lorenz bifurcation operation and partial resection of the femur.

When reduction is secured it is desirable to insure its maintenance. Frequently a large pocket remains in the capsule into which the head can easily redislocate, and usually the capsule will not contract sufficiently to obliterate this pocket. The relaxation is generally greater anterosuperiorly, due to the dislocation of the head in this direction. A crescent of this portion of the capsule, large enough to correct the relaxation but not large enough to impair external rotation, is excised. The amount of anteversion and its effect are determined at operation. The hip is ad-

ducted by means of upward pressure with the knee forward and again with the knee in sufficient internal rotation to correct the anteversion, and the point of redislocation is noted. As the abduction is reduced, if the femur dislocates before reaching a neutral lateral position with the knee forward, but remains socketed to 15 degrees or more of adduction in internal rotation, it will usually be desirable to correct the anteversion. This is done three to six weeks after reduction by a transverse supracondylar osteotomy, the upper fragment being maintained in internal rotation by a steel pin driven through the femur below the greater trochanter and incorporated in the plaster. The anteversion need rarely be corrected unless it is greater than 45 degrees.

The hip is immobilized in a plaster-of-Paris spica from mid-thorax to toes, including the opposite thigh if it is advisable to fully immobilize the pelvis. The spica may be removed in six weeks if the reduction is very stable, but it is usually left on for two months, rarely longer. When there is a probability of stiffness, the plaster may be bivalved from the foot to the groin three or four weeks after operation and daily motion may be begun. The child is not allowed to walk at once upon removal of the spica, but is kept in bed from one to four weeks, and massage and motion are begun. Roentgenograms are made with the hip in traction and also with upward push to demonstrate possible instability. When pain and spasm are absent, motion is fair or good, and there is no telescoping, walking is begun,—first with crutches, then without support. The principle of treatment at this stage is to begin mobilization at the earliest safe moment and to delay weight-bearing until the extremity has recovered sufficient function.

#### CONCLUSIONS

1. Successful closed reductions were obtained in 42 per cent. of 492 hips with congenital dislocation.

2. Successful open reductions were obtained in 77 per cent. of 122 such hips; the results in forty-nine of these hips are here reported for the first time. Good functional results were secured in 78 per cent. of the open reductions.

3. Closed manipulation is the operation of choice for patients in the first year of life and may be attempted in children up to three years of age, but open operation is preferred after the age of two. The shelf-stabilization operation is the most satisfactory operation for most children over six years of age.

4. Traction with adhesive tape before reduction is of little or no value, but may be useful after reduction when there is some tension at the hip.

5. The chief factors in redislocation are the size and shape of the acetabulum and the redundancy of the capsule. The acetabulum should be large enough to allow the head to enter well and move smoothly, and its roof should be round and horizontal rather than oblique. Cartilage may

be removed from the roof to accomplish this purpose. The capsule, when adherent, should be freed superiorly and a sufficient section removed to prevent redundancy, and anatomical closure should be secured. Anteversion often favors redislocation and should be corrected when such is the case.

6. The principal causes of postoperative limitation of motion which can be avoided are tension of the tissues about the hip joint, due either to the reduction or to the position of immobilization, damage at the superior acetabular margin, and the presence of a large area of raw bone or raw soft tissue.

7. Coxa plana in congenital dislocations is due to the circulatory disturbance caused by tension upon the capsule and adjacent tissues of the joint, and is almost wholly avoidable.

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## THE SHELF OPERATION IN THE TREATMENT OF CONGENITAL DISLOCATION OF THE HIP \*

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Plastic operations in the treatment of congenital dislocation of the hip have been devised to solve one of two definite problems; first, that presented by a deficient acetabulum; second, that presented by the neglected case with irreducible dislocation. Both these conditions give rise to increasing instability in the affected hip and eventually to disabling interference with function. The overcoming of these handicaps necessitates some form of constructive surgery which aims to provide a stable, weight-bearing joint.

The problem presented by a deficient acetabulum is a comparatively simple one, since it involves only the converting of an inadequate acetabulum into an adequate one, in order that the dislocated head once reduced may be retained in place. A type of shelf operation described by Albee and Jones has satisfactorily met this requirement. This operation consists of turning down the superior margin of the acetabulum and wedging it into its new position with a graft taken from the tibia. The purpose of this procedure is to deepen the acetabulum and provide an adequate overhanging roof in place of an inadequate sloping one. This operation has been used in our Clinic for years in properly selected cases, both at the time of open reduction, if the roof of the acetabulum is insufficient, and as a secondary procedure when inadequacy of the acetabulum develops subsequent to reduction, as has occurred from time to time. This type of plastic operation is so well known that it needs no further discussion.

The problem presented by the neglected case of congenital dislocation of the hip apparently has not been so satisfactorily answered, since a number of operative procedures have been advised for its correction or relief. The reason for this is evident when we appreciate that in the neglected case we are dealing with a congenital dislocation which, in the majority of instances, is irreducible; consequently, the problem is more complex and one which naturally affords opportunity for the development of different avenues of approach in the effort to solve it. The purpose of this symposium is to place before you the types of operative procedure used in neglected cases which are recognized to-day as most satisfactory in their results; this should be most helpful to all of us.

In the management of congenital dislocation of the hip it must be recognized that, while it is possible by manipulation or open reduction to replace the dislocated head in the acetabulum in children up to seven years of age, beyond this age a congenital dislocation of the hip must, in

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester, Minnesota, June 7, 1934.

the majority of cases, be considered as irreducible. In other words, there is an age period in congenital dislocation of the hip within which reduction and physiological cure are possible, and an age limit beyond which actual reduction of dislocation is impossible or, if possible, undesirable. Reduction in these cases is impossible because, without the use of extreme force and the running of unjustifiable risks, the thickened and contracted capsule and extreme shortening of the muscles which pass from the pelvis across the hip joint to the femur prevent the displacement of the head downward sufficiently to allow it to enter the acetabulum. Reduction is

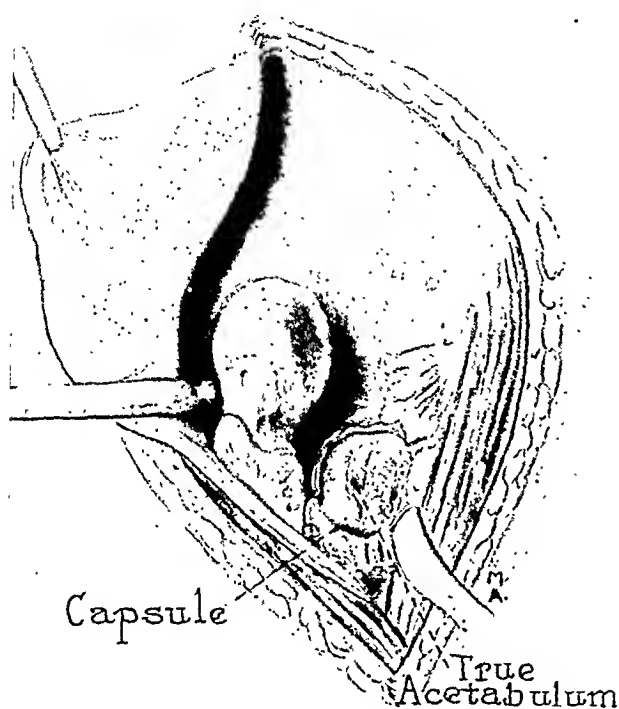


FIG. 1

The capsule has been cut away and all restricting structures divided or stripped back, and the head is completely free. The lever is in position to slide the head forward onto the ridge between the anterior and posterior planes of the pelvis or onto the anterior plane. (By courtesy of *Surgery, Gynecology and Obstetrics*.)

treatment must, in the majority of instances, aim at stabilizing the hip and improving the function of the joint without restitution of the dislocated head. We must, in other words, abandon the ideal of a physiological cure, possible in the early cases, and be satisfied with what Kreuz of Berlin has termed a pathophysiological cure.

Efforts to devise a satisfactory method of stabilizing a congenitally dislocated hip and at the same time to preserve a useful amount of motion without restoring the dislocated head to the acetabulum have produced a variety of operative procedures. One type of procedure, the shelf

undesirable in these cases because, even if the reduction can be accomplished by the use of great force, the head is thrust so strongly against the acetabulum by the contracted structures about the hip joint that absorption of the articular cartilage follows and rigidity or complete ankylosis results in a very high percentage of the cases. Ankylosis, or even marked limitation of motion, is a very disabling condition, and the strong probability that it will occur constitutes a definite contraindication to replacing the femoral head in the acetabulum in these older cases. Our problem, then, in the neglected case of congenital dislocation is quite different from that in the early case and our

operation, has been extensively used in this country for the past fifteen years and has been used exclusively in our Clinic during this period. It is this particular type of plastic operation for the treatment of irreducible congenital dislocation of the hip which will be discussed in this presentation.

The shelf operation, as used in neglected or irreducible congenital dislocation of the hip, aims: (1) to improve the weight-bearing position of the head of the femur; (2) to stabilize the dislocated hip for weight-bearing purposes; and (3) to preserve a useful amount of pain-free motion in the hip. To accomplish these three cardinal purposes we believe a definite technique is necessary. The procedure as carried out in our Clinic has varied but little from that described by the author in 1924<sup>1</sup>. The complete technique as used today has been more recently published<sup>2</sup>. A discussion of the details of the operation will, therefore, be omitted since its repetition here would be superfluous.

Without attempting to discuss the various steps which must be carried out in performing the shelf operation, it may be stated that there are four of these which are essential to its success:

1. Complete mobilization of the head must be secured through free resection of the capsule and the division of all restricting fibrous bands (Fig. 1);

2. The head of the femur must be displaced

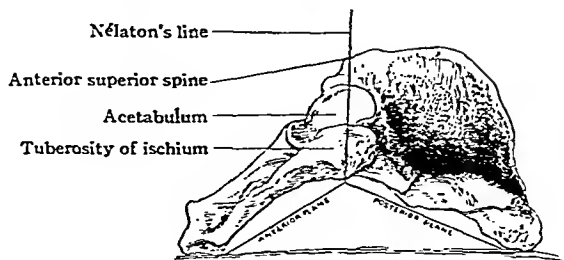


FIG. 2

The anterior and posterior planes of the pelvis are shown with the ridge between. (By courtesy of *Surgery, Gynecology and Obstetrics*.)

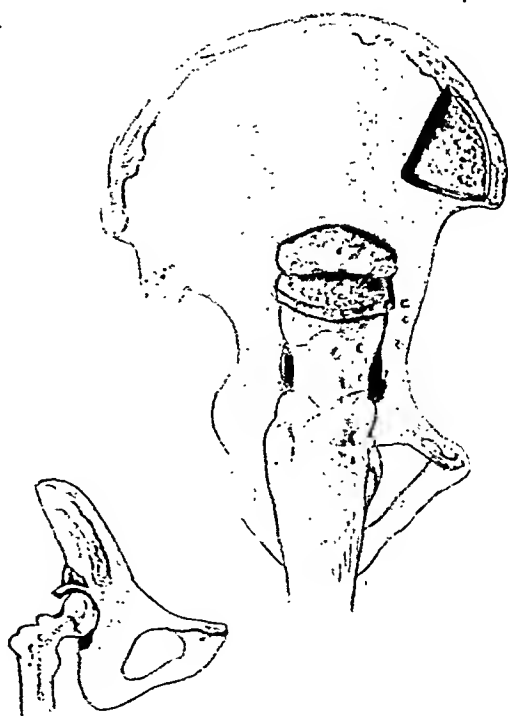


FIG. 3

Wedge of bone has been removed from the crest of the ilium and fixed between the side of the ilium and the turned-down flap. (By courtesy of *Surgery, Gynecology and Obstetrics*.)

from the posterior plane of the pelvis forward onto the anterior plane of the pelvis or the ridge between the anterior and posterior planes (Fig. 2);

3. An adequate shelf in the form of a cap must be turned down over the head in its new position (Fig. 3);

4. Traction on the operated extremity must be continuous from the time the shelf has been turned down until four to six weeks have elapsed.

Failure to strictly carry out these essential procedures will jeopardize the success of the operation. It should be emphasized that the shelf operation as done in our Clinic does not include any attempt to form a new acetabulum by gouging out or reaming out a cavity in the wall of the ilium. With a properly constructed shelf, this is unnecessary; we feel that this added procedure complicates the operation, tends to increase the amount of reaction at the operative site, and adds to the risk of limitation of motion in the new joint through excessive scar and connective-tissue formation.

The results of the shelf operation may be described as satisfactory so far as function is concerned, but fall far short of ideal cure. With few exceptions, a stable hip has been secured with sufficient motion for ordinary use. There have been improvement of lordosis, relief of symptoms, a definite gain in length, and improvement in gait in the vast majority of the cases operated upon. The results, so far as we can determine,

are lasting. The five oldest cases were operated upon fifteen years ago and all these patients are now leading active lives without symptoms or any interference with active use of the hip (Fig. 4).

From our own experience and the observation of cases operated upon by others, it would seem that unsatisfactory results are traceable to one of three causes; (1) failure to sufficiently mobilize the head and displace it forward; (2) attempts to secure too much lengthening; (3) too long immobilization following operation. It has been surprising to discover that many operators have been satisfied with turning down a shelf of bone over the posteriorly displaced head, making no attempt to improve the weight-bearing position of the head



FIG. 4

Roentgenogram showing type of shelf secured.  
(By courtesy of Surgery, Gynecology and Obstetrics.)

by restoring it to approximately its normal position above the true acetabulum. Failure to do this certainly prevents any improvement in the tilting of the pelvis and correction of the lordosis, a very important advantage secured by the shelf operation properly done. Attempts to secure too much length will result in the same excessive pressure against the head which occurs in these older cases if the head is restored to the acetabulum, with absorption of articular cartilage and rigidity or ankylosis of the joint. If movement is not commenced early—at least within four weeks after operation—adhesions and scar tissue may form, with the result that flexion deformity is likely to develop and motion of the hip is seriously interfered with. In a few instances it has been necessary to do a secondary operation to relieve this condition, always with satisfactory improvement in the position and movement in the hip.

We have performed the shelf operation in twenty-eight dislocated hips with the following results:

Satisfactory results.....	23 or 82.2 per cent.
Improved.....	2 or 7.7 per cent.
Failures.....	3 or 10.1 per cent.

The youngest patient operated on was nine years old; the oldest, forty-six years old. There have been no deaths in cases operated upon, nor have any serious complications occurred. Unduly prolonging the operation and attempting to obtain too much lengthening should be avoided, as they tend to cause shock.

The question as to whether or not any form of operation is indicated in irreducible double congenital dislocation of the hip is being constantly asked. It has been our conviction that this type of case should not be operated upon, unless symptoms of a disabling character develop. When, however, such indications exist, there is no good reason which can be advanced against attempting to relieve the patient by a shelf operation or some other form of stabilizing procedure. The cosmetic result has been poor in the few cases which have been operated upon in our Clinic, but the relief from symptoms has been striking.

To summarize, the results to be expected from a properly performed shelf operation are:

1. A pain-free, stable, freely movable hip, with limitation of motion only in the extremes of the arc.
2. Improved weight-bearing, combined with improvement or disappearance of lordosis and its accompanying symptoms of backache.
3. A definite decrease in the shortening, averaging about one inch.
4. Improved walking because of the resulting stability and lessening of the give in the hip on weight-bearing.

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PLASTIC CONSTRUCTION OF AN ACETABULUM IN CONGENITAL DISLOCATION OF THE HIP—THE SHELF OPERATION\*

BY A. BRUCE GILL, M.D., PHILADELPHIA, PENNSYLVANIA

This paper is based on the author's experience during the past fifteen years in operations on 125 cases of congenital dislocation of the hip. Inasmuch as he has already made two presentations of this subject before the American Orthopaedic Association—in 1923 <sup>1</sup> and in 1928 <sup>2</sup>—repetition will be avoided as far as possible.

GENERAL STATISTICS

Number of operations.....	125
Number of patients operated upon.....	105
Male..... 21      Female.....	84
Unilateral dislocation....	84
Bilateral dislocation.....	28
One hip only operated on.....	8
Both hips operated on.....	20
Age of patient at time of operation:	
2- 4 years, inclusive.....	14
5- 9    "        "        .....	47
10-14    "        "        .....	37
15-19    "        "        .....	14
20-30    "        "        .....	10
45        "        .....	1

BLOODLESS REDUCTION

The author always attempts bloodless reduction by gentle manipulation in children under five years of age unless the joints are abnormally rigid or unless the roentgenograms show too much obliteration of the acetabulum. In the case of the former, experience has shown that it is impossible to reduce the dislocation by gentle procedures, if at all; and in the case of the latter, if reduction is obtained, redislocation will almost surely occur at some later time.

After reduction has been obtained, the hip is fixed in a plaster cast for four months, occasionally for six months for some particular reason. The cast is then removed and the child is allowed to kick and crawl about in its crib. If redislocation occurs, an open operation is done, as described later under Type I. If the hip remains in place after a few weeks of such activity in bed, the child, if of a walking age, is gradually allowed to resume complete weight-bearing.

The author believes that, if a femur will not remain in the acetabulum after four months in plaster, the probabilities are that it will not do so even

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester, Minnesota, June 7, 1934.

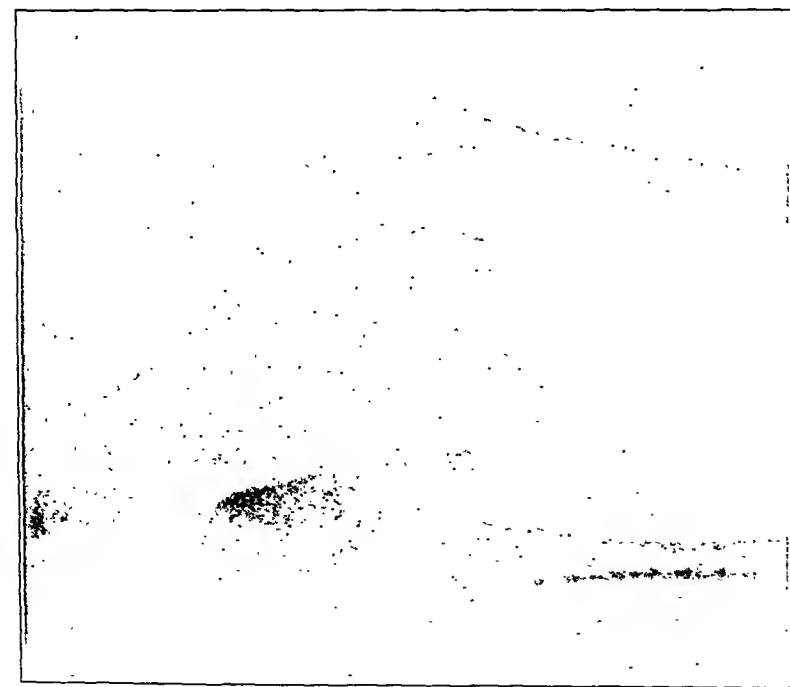


FIG. 1

M. Y., aged seventeen months. Type 1. Bloodless reduction failed.

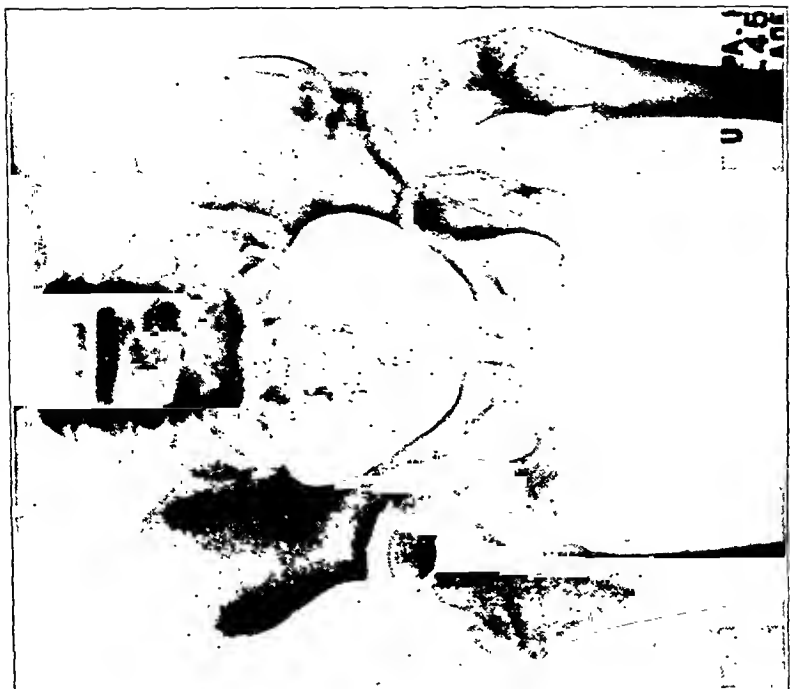


FIG. 2

M. Y., two and one-half years after operation. Normal motion.

after ten to twelve months in plaster. There are two reasons for this belief. When, in former years, all patients were kept in plaster casts for a period of from eight to twelve months, a certain percentage of them suffered from redislocation soon after the casts were removed or years after. In the second place, it has been observed frequently by the author that, in cases of bilateral dislocation, one hip remains secure in the socket for life after four months in plaster, while the other does not.

It may be argued that these insecure hips might become secure after many months or even years in plaster, but it seems reasonable to believe that this is not true of all such hips, or, indeed, of the majority of them. Why then subject the child to such prolonged treatment and inactivity when by operation you will have her walking with a stable hip in three months?

#### TREATMENT OF IRREDUCIBLE DISLOCATIONS

*Preoperative Treatment:* In a former paper the author stated that he had originally employed traction in cases of high dislocation, but had discontinued it as ineffective. However, after 1928, he began to employ casts with turnbuckles and has found this method frequently to be very effective in drawing the head of the femur downward to the region of the original acetabulum. The Anderson splint has been tried faithfully and persistently, but without satisfactory results.

The traction by the turnbuckle casts is conducted slowly in order to avoid pain and to prevent sloughs. The procedure may require from one to four months.

#### TYPES OF DISLOCATION AND THE RESULTS OBTAINED BY OPERATION

As these types of dislocation, with the operation appropriate for each, have been described in detail in a previous paper<sup>2</sup>, only a résumé of them is presented here.

##### *Type I—Figures 1 to 4*

The head of the femur is in the acetabulum or can be placed there, but the acetabulum is too shallow to hold the head securely. Dislocation recurs in children, as described in a preceding paragraph; in adults, the hip is subluxated and is unstable and painful.

*Operation:* The capsule is not opened. A bone shelf is turned down above the head and forward from behind. The entire roof of the acetabulum is reflected downward by driving an osteotome deeply into the ilium just above the roof and prying the roof down, and bone wedges from the crest of the ilium are driven deeply into this open space to maintain the roof and the bone shelf securely in position.

*End Results:* Fifteen patients have been operated upon. Motion in all is normal, as nothing is done in the operation which can possibly limit the motion which was present in the hip before operation.

In all cases the hips are stable and painless. In none has redislocation occurred. The roentgenograms of two cases show what appear to



FIG. 3

M. H., aged seventeen years. Type I.



FIG. 4

M. H., two and one-half years after operation. Normal motion.



FIG. 5  
E. C., aged ten years. Type III.



FIG. 6  
E. C., six weeks after operation.



FIG. 7

E. C., eight months after operation.

be insufficient sockets with partial disappearance of the bone shelf, but, nevertheless, the dislocations have remained reduced and the hips are stable.

In one case, at the time of operation, the acetabular roof was turned down, but a bone shelf was not constructed because the socket appeared to be deep enough to contain the entire head. Redislocation subsequently occurred. This mistake has not been repeated.

### *Type II*

The head cannot be replaced in the acetabulum without opening the capsule. Fibrous and fatty tissue is removed from the acetabulum. Occasionally a little, but never all, of the cartilage must be removed also. Reduction is obtained, the capsule is closed by sutures, a bone shelf is formed, and the roof of the acetabulum is reflected downward.

*End Results:* In thirty cases of this type the patients have been operated upon. Motion has always been satisfactory and sufficient for all ordinary functions of the hip. Flexion has varied from 60 degrees to well beyond 90 degrees. Abduction is good. Rotation has been moderately limited in those cases where there has been considerable abnormality in the shape of the head.

All the hips have remained stable and painless. The patients lead normal lives and frequently engage in school athletics.



FIG. 8  
J. V., aged twelve years. Type III.



FIG. 9  
J. V., six weeks after operation.

*Type III—Figures 5 to 10*

The dislocated head lies higher and cannot be brought down quite to the site of the original socket. The socket must be enlarged upward from one-quarter of an inch to one inch until the head slips in easily and the soft structures are not under undue tension. The shelf and the acetabular roof are turned downward as already described. In closing the wound, the free edge of the capsule is brought up over the free margin of the shelf.

*End Results:* Thirty-four operations have been done. Motion has varied from 30 degrees to more than 90 degrees. Stability has been perfect in all cases. Functional results have been good.

*Type IV—Figures 11 and 12*

The head lies very high and cannot be dragged downward anywhere near the site of the original socket. A new acetabulum is formed several inches above the primary one.

*End Results:* Thirty-one patients have been operated upon. In some few cases there is only from 20 to 30 degrees of motion, and in a few cases it has approached 90 degrees. In most operations of this type the surgeon may feel sure of obtaining from 30 to 45 degrees. Stability is perfect. Very few patients ever complain of pain after prolonged use of the limb. All state that their condition has been tremendously improved by the operation. They are able to lead useful lives in spite of a limp and limitation of motion.

*Type V*

The neck of the femur is absent or so short that the head cannot be placed in the old or in a newly formed acetabulum. In some cases the capsule has been found to be attached to the femur at the very edge of the cartilage of the head. In one case several fibrous bands were observed springing from the capsule and attached to the articular cartilage of the head itself, three-eighths of an inch from its margin.

In these cases the neck must be lengthened by a transposition of the great trochanter downward on the shaft. The capsule must be detached from around the edge of the head or from the neck, and the femur thrust upward through the opening thus formed. The head will then securely enter the socket and the capsule will form a new attachment to the femur below the original site of the great trochanter.

This type of dislocation has been found most frequently in young children.

*End Results:* Fifteen operations have been done. In this type of hip there may result severe loss of mobility for a time, due to the extensive scar-tissue formation in the soft tissue of the hip joint, but marked improvement occurs as time passes. Stability has always been complete.

*Type VI*

In this type congenital dislocation is complicated by infantile paralysis. When there is a complete paralysis of all the muscles of the hip the



shelf operation cannot be expected to give a good result. The relaxation of all the soft structures of the hip joint is so great that the head will not remain in any newly formed socket. In one case, the author found that with his hands he could move the head into any position,—forward, backward, and upward. An arthrodesis is the operation of choice in these cases.

In cases of less severe paralysis, when the gluteal muscles are of fair power, the hip is to be treated as one of the types previously described.

*End Results:* Nine patients were operated on, and of these four suffered a relapse.

In recent years no operations have resulted in bony ankylosis. If some free motion is present six months after operation, it has been found that this has progressively improved throughout a period of four or five years. The surgeon should not be discouraged at the end of six months or a year.

In a few cases, tenotomy of the adductor muscles has been performed after operation to secure better abduction; and, in one case, a subtrochanteric osteotomy of the femur was done for the same purpose. But seldom has a tenotomy of the adductor tendons been necessary during the plastic operation.

#### GENERAL FINDINGS

*Mortality:* There have been no deaths in this series of cases. Seldom do these patients present any symptoms of operative shock.



FIG. 10

M. B., aged seven years. Type III. Showing end result six years after operation. Almost normal motion.



FIG. 12

A. L., two years after operation. Sixty degrees of motion.



FIG. 11

A. L., adult. Type IV.

*Infection:* There has been but one case of infection, already reported in a preceding paper.

*Version of the Neck:* In the paper published in 1928<sup>2</sup>, the author stated that he had never seen sufficient anteversion of the neck to require consideration during or after operation. Since then he has had three cases in which, at the time of operation and immediately after, the head could be kept in the socket only by flexing and internally rotating the femur. But in all of these cases, as the leg was brought down gradually to the normal position, the head remained in place and ceased to be prominent anteriorly.

The author has never been obliged to do a rotation osteotomy of the femur or to pay any attention to anteversion beyond a few months after operation. It is his opinion that the version of the neck is corrected by physiological processes after normal function has been established in the hip joint.

*Ligamentum Teres:* In numerous cases the ligamentum teres has not been found at the time of operation. In cases of high dislocation, it is elongated, thickened, and frequently broadened. It often must be excised to permit the head to be placed in the socket.

*Deformity of the Head:* A normal head is never observed in the older cases of dislocation. It is usually much flattened on the side where it lies against the pelvis. It may be conical, or shaped like a mushroom. It may have on it several wartlike excrescences. Part of it may be devoid of articular cartilage. At times the cartilage is very loosely attached about its margin. Some heads have been observed that are shaped like a door knob.

The author has frequently reshaped the head before restoring it to the socket.

In studying the roentgenograms of these hips taken some years after operation, the author has frequently seen a malformed head fitting into a malformed socket. Sometimes this condition has been quite marked and yet the patient has had good motion and good function in the hip. The author is inclined to believe that the socket molds itself to fit the head. It may be that the reverse occurs.

*Legg-Perthes Disease:* This is a common condition accompanying congenital dislocation. It is observed in many roentgenograms taken before reduction, and it is also frequently seen after reduction.

*Adherence of the Capsule to the Pelvis:* This condition has always been observed in the older cases. The capsule may be attached to the ilium for an inch or more above the acetabulum, as pointed out by Kidner. The author has always separated the capsule from the ilium with an osteotome to expose the upper brim of the socket before making the incision through the capsule into the hip joint, and to render it easier to move the head forward and downward.

Sometimes the capsule has been drawn taut across the acetabulum and is adherent to its margins like the head of a drum.

## OPEN REDUCTION WITHOUT A PLASTIC OPERATION

It has been the author's custom for years to make a bone shelf and to reflect the roof of the acetabulum downward in all open operations. Within the past two years he has violated his rule in two instances because the socket seemed sufficiently large and deep to hold the head permanently. In these two cases reduction was accomplished and the capsule was firmly closed with sutures. In both cases, however, redislocation occurred and a second operation was done to form a better socket. It is the author's opinion that, if open reduction is necessary in any case, it is better to construct the shelf and reflect the roof at once. It requires but little more time and gives a better guarantee of a stable hip.

## CONCLUSION

The author has experienced an increasing satisfaction with the results of these operations as the years have passed.

No claim is made that perfect functional results are obtained in the cases of old and high dislocation. Normal motion cannot be expected. But the stability of the reconstructed hip and the freedom from pain enable the patients to lead often surprisingly useful lives in spite of a limp, limitation of motion, and shortening. Without exception, the patients state that they have been greatly improved. In cases of bilateral dislocation, where only one hip has been operated upon, the patients invariably state that the condition of this hip is better than the one which has not been operated upon.

Cases described under Type V present the greatest technical difficulties of operation.

A judicious combination of reduction by bloodless and by open operative methods should give us almost 100 per cent. successful results in young children.

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# THE TIBIAL PEG SHELF IN CONGENITAL DISLOCATION OF THE HIP \*

BY EDWARD L. COMPERE, M.D., AND DALLAS B. PHEMISTER, M.D.,  
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A shelving operation is indicated in congenital dislocation of the hip when open reduction is accomplished and the acetabulum is too shallow; when, in older cases, the femoral head cannot be reduced; and, after closed reduction, when with usage the acetabulum proves to be inadequate. This operation is also indicated in the case of a congenitally inadequate acetabulum in which, during adult life, the hip becomes painful.

König, in 1891, first reported the construction of a shelf by turning down the outer cortex of the ilium, and this has continued to be the chief source of bone, either for the reenforcement of the old acetabulum or for the construction of a new one.

This type of procedure with various modifications has given fairly satisfactory results. The advantages are the ease and simplicity of performance of the operation. It has, however, certain disadvantages. One is that the shelf may not be turned down sufficiently low (Figs. 1-A and 1-B). Another is that the reflected bone is sometimes unstable in its new position. A third disadvantage is that postoperatively muscular contraction tends to displace the femur upward, especially if it has been pulled downward and if complete reduction has not been accomplished. Failure to place and to maintain the iliac graft low enough over the reduced or partially reduced femoral head so as to stabilize the hip satisfactorily has been noted in the published roentgenograms of other surgeons,—such as Crego, Haas, and Hey Groves.

To obviate these disadvantages, various procedures for stabilizing the iliac shelf have been employed by Albee, Jones, Hallopeau, Dickson, Lance, Gill, Hey Groves, Ghormley, Lowman, and Haas. The results on the whole have shown improvement over those previously obtained. Continuous traction and pin fixation to the cast have been used to hold the femur down.

After reduction of the dislocation, Spitzzy introduced a single long tibial graft alongside a metal guide into the ilium just above the acetabulum. In some cases he then inserted a second tibial peg through the neck and head into the acetabulum for better temporary fixation. A serious objection to this procedure is that his illustrations show that longitudinal growth of the neck was arrested in the region of the peg.

Roeren, in 1929, reported the use of two whole-thickness tibial grafts

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester, Minnesota, June 7, 1934.

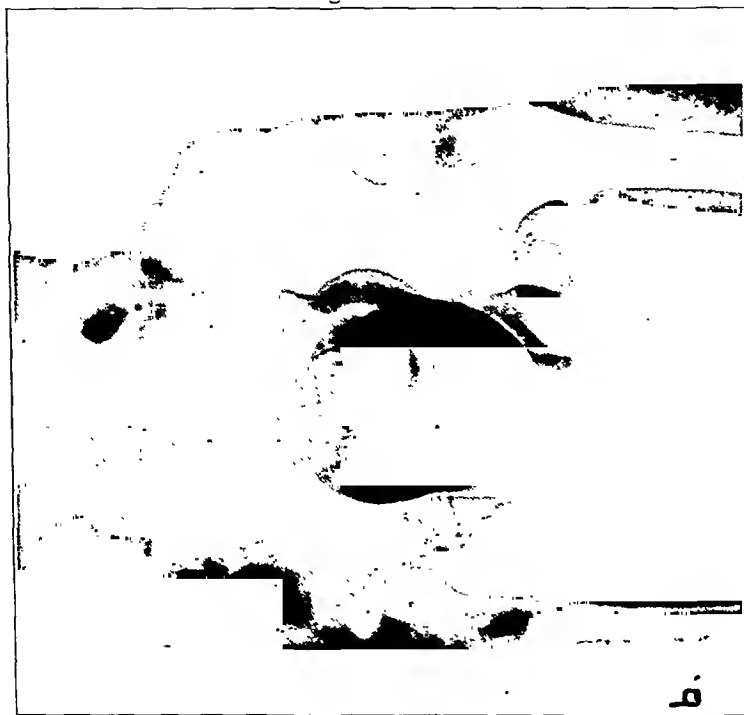


FIG. 1-B

M. B., female, aged eight years. Congenital dislocation of the left hip had been accurately reduced by open operation, but the shelf had been placed too high to maintain the reduction. The iliac shelf has been further displaced upward since weight-bearing was begun.

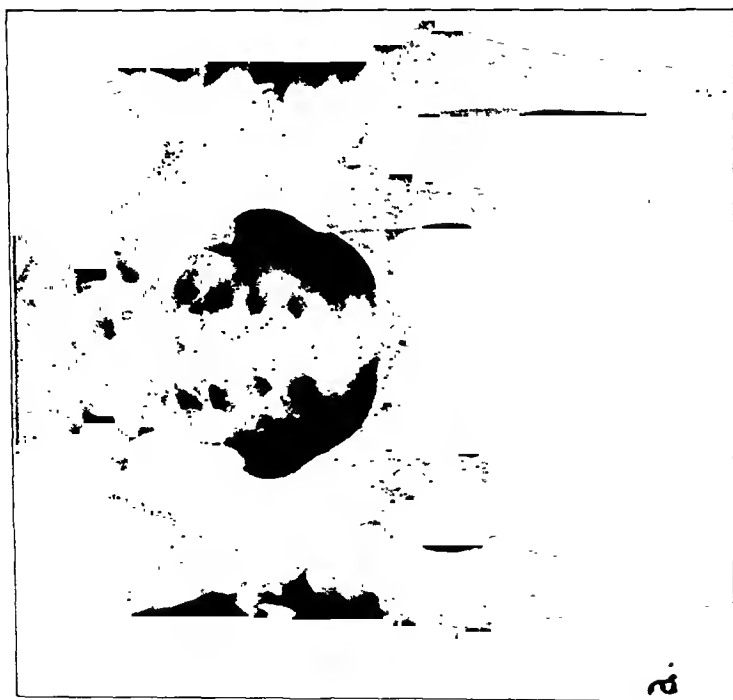


FIG. 1-A

L. D., female, aged twelve years. Bilateral congenital dislocation of the hip had been reduced when patient was three years of age. Pain in both hips had been growing increasingly severe for two years. X-ray shows inadequate acetabula over which an attempt has been made to turn down an iliac shelf. Neither shelf, however, is turned down to the rim of the acetabulum.



FIG. 2-A

Case 1. G. F., male, aged thirteen years.  
Upward displacement of the head of the femur.



FIG. 2-B

The hip has been pulled down approximately three centimeters and shelved with the three full-thickness tibial pegs. An additional wedge of bone from the tibia has been placed in the angle above.



FIG. 2-C

The grafts have fused together, forming an arched roof which is stable and which has maintained the reduced position of the hip.

to form an arched roof above the acetabulum after open reduction of the dislocated hip.

Juvara used a single broad tibial graft for the same purpose.

The use of three tibial peg grafts for the construction of an acetabulum was stimulated by the following case:

**CASE 1.** G. F., a male, aged thirteen, was admitted to the University of Chicago Clinics on July 22, 1931, with a diagnosis of congenital dislocation of the left hip. Closed reduction had been done at the age of two and one-half years, but the reduction had not been maintained.

Examination revealed a positive Trendelenburg sign, limitation of abduction, and two and one-half inches of shortening (anterosuperior spine to internal malleolus).

Traction was applied to the leg for two weeks, which resulted in pulling the head of the femur down a distance of about four centimeters.

At operation, on August 7, 1931, with the extension apparatus applied, the hip was exposed by a Smith-Petersen incision. The capsule was not opened. Three bone grafts, measuring two by five by five-tenths centimeters, taken from the whole thickness of the right tibial crest, were then inserted into slots and drilled through the ilium to form a low arched roof. Two additional heavy grafts from the tibia were laid on top of these in front and behind, and additional fragments of bone were applied. (See Figure 3.) The wounds were closed and a body cast was applied, including the entire left leg and the thigh of the right leg. The operative time was an hour and ten minutes.

Immobilization was continued for approximately six weeks. The patient walked with crutches for about two months and with a cane for the following two months. On January 4, 1932, examination showed that the patient still had a limp when walking and that there was motion of 45 degrees in flexion. The left leg was two and one-third inches shorter than the right at this time.



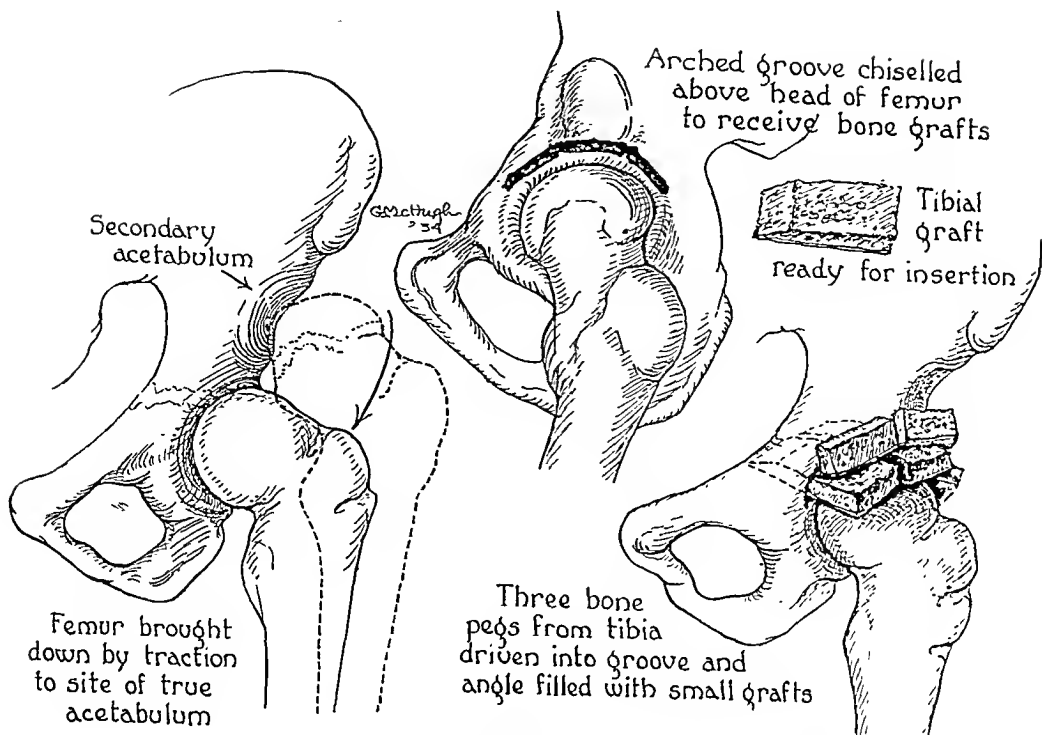


FIG. 3

Diagrammatic illustration of the tibial-peg-shelf operation.



FIG. 4-A

Case 2. S. A., female, aged ten, bilateral dislocation. The left hip has been reduced, but the acetabulum is inadequate.

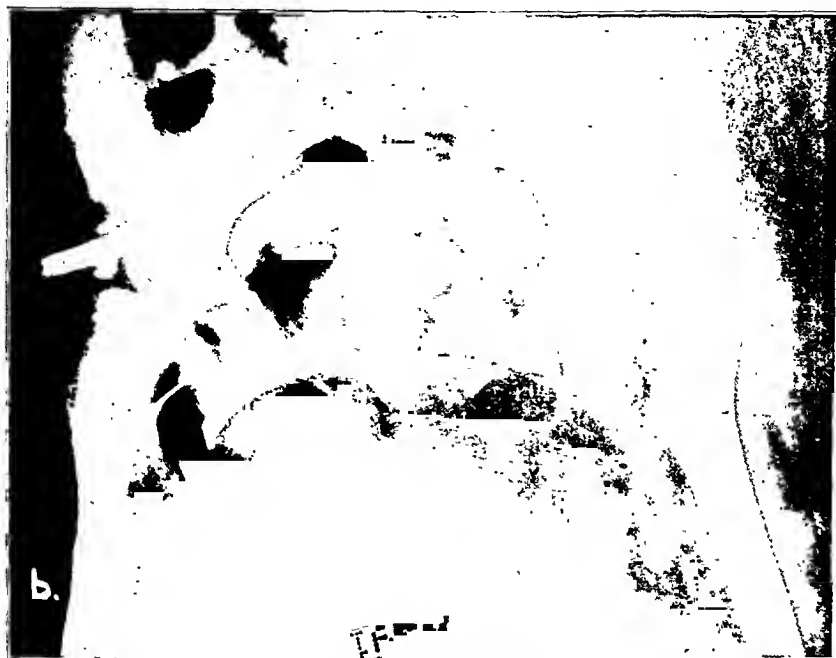


FIG. 4-B

Tibial-peg shelves have been constructed at the acetabular margin of the reduced hip and just above the head of the dislocated hip.



FIG. 4-C

The x-ray shows the satisfactory arched roof of the left acetabulum. The shelf over the right hip has partly melted away, but the hip is clinically stable.

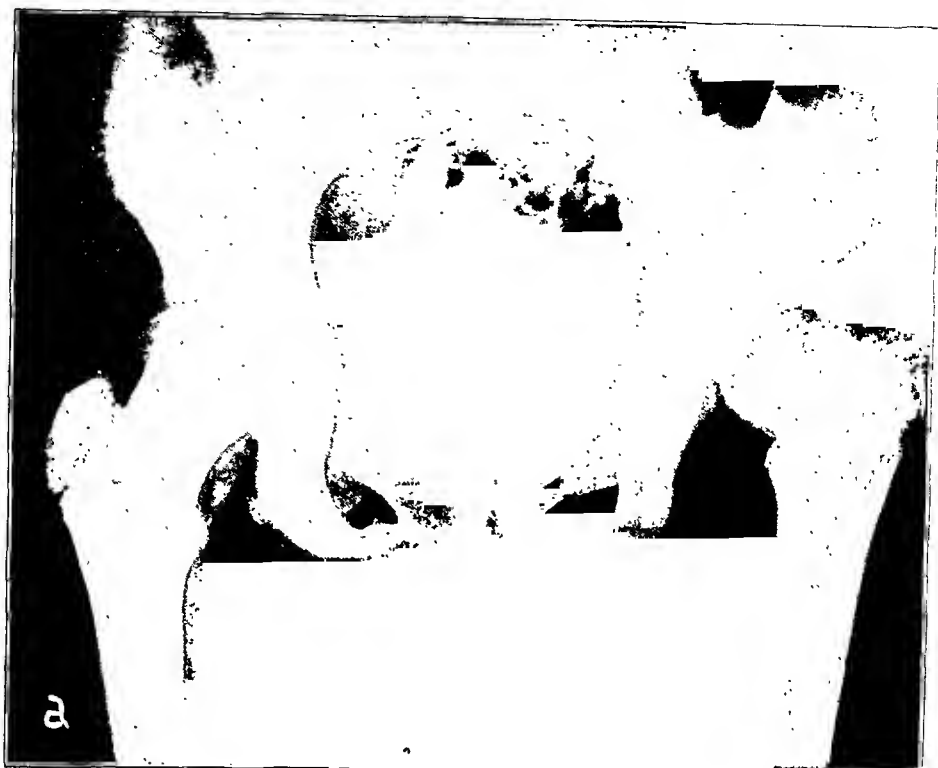


FIG. 5-A

Case 3. T. P., female, aged eleven.  
Dislocation of the left hip with secondary acetabulum. Note deformity of the head of the femur.



FIG. 5-B

Shows reduction of dislocated left hip, with tibial-peg grafts driven firmly into the ilium holding the hip in the primary acetabulum.

The patient was readmitted to the hospital on April 8, 1932, and an epiphyseal arrest of the lower end of the right femur was performed.

He was last seen in this Clinic December 29, 1933, at which time he stated that he was able to walk several miles without pain in the hip. A limp was still present, but definite improvement was noted. Range of motion was about 50 per cent. of that of the normal right hip. Teleroentgenograms were taken at this visit and these showed the combined length of the left femur and tibia to be two centimeters greater than that of the right. X-rays of the hip showed a strong, well formed shelf which had withstood weight-bearing and which had gradually been molded to accommodate the femoral head more adequately. Because of the high location of the new acetabulum, the left limb was still one and one-half inches shorter than the right.



FIG. 5-C

The tibial bone has fused together, forming an adequate socket for the femoral head.

Since its use in this case, the tibial-graft shelving operation has been employed in fourteen other cases of congenital dislocation of the hip, and in five cases of pathological dislocation following pyogenic arthritis, with destruction of the head and the neck of the femur.

The following are illustrative cases:

**CASE 2.** S. A., a girl, aged ten, had been seen at the age of two years at the Clinic of the Home for Destitute Crippled Children where a diagnosis of bilateral congenital dislocation of the hip had been made. She had been treated by manipulation and the application of a cast. The dislocation of the left hip had remained reduced, but the right hip had continued to redislocate.

When first seen in this Clinic in 1931, at the age of eight years, the patient was beginning to complain of pain in the right hip. This pain persisted and increased during the subsequent two years. She had a waddling gait, a positive Trendelenburg sign on the right, and a questionable Trendelenburg sign on the left. No preliminary traction was used.

Since the patient had developed a satisfactory secondary acetabulum on the side of the ilium of the unreduced right hip, the tibial-peg operation was performed on June 19, 1933, without attempting to pull the head of the femur down to the poorly developed primary acetabulum. The x-ray revealed an inadequate left acetabulum which was not only shallow, but whose superior lip had been eroded slightly upward (Fig. 4-A). This hip was shelved with the tibial-bone pegs on July 1, 1933. Immobilization in a cast was maintained for three weeks, after which exercises were started. The patient was permitted to swim in the tank and weight-bearing in the water was permitted.

At the present time the patient has normal extension, normal adduction, 45 degrees of abduction and 90 degrees of flexion in the right hip and approximately normal range of motion in the left hip. She has no pain. There is a negative Trendelenburg sign on the left side, but the right gluteus medius is not sufficiently strong to prevent the pelvic droop when she stands on the right leg. Strength and stability of the right hip have shown steady improvement. She is now able to walk without any limp in water at a depth of three and one-half feet.

CASE 3. T. P., a girl, aged eleven, gave a history of a limp since she began to walk at the age of two years. This had become progressively more marked.

Examination at the Clinic of the Home for Destitute Crippled Children revealed on the left a positive Trendelenburg sign, trochanter above Nelaton's line, and leg one and one-half inches shorter than the right. X-rays showed congenital dislocation of the left hip. The head and neck of the left femur were grossly deformed and the hip had dislocated upward (Fig. 5-A).

The tibial-bone-peg operation was performed April 12, 1933. It was not necessary to open the joint capsule. Patient is now able to walk without any limp in water which is waist deep. She has a negative Trendelenburg sign, but a slight limp is noted when she walks with her full weight on this hip. There is no pain and the range of both active and passive motion is about 75 per cent. of normal.

CASE 4. The most recent case in our series is that of a female, M. W., aged twenty-five years, with bilateral congenital dislocation of the hip. She walked with a limp until she was six years of age. At that time an unsuccessful attempt was made to reduce the dislocation of the left hip by closed manipulation. When she was approximately seven years of age, an open operation was performed, but this reduction was not maintained. She was reoperated upon at the age of eight years and, after this, was able to walk with less disability. From the age of eight until one year ago she had no pain, but, during the past year, she has been having pain in the right hip in which she had never had symptoms previously.

Examination at the time of admission showed free range of motion in all directions in the left hip. There was pain upon motion or weight-bearing and limitation of abduction, flexion, extension, and internal rotation in the right hip.

The x-rays taken at this time showed bilateral congenital dislocation of the hip (Fig. 6-A). The left hip, which had been subjected to one closed manipulation and two open operations, showed gross malformation of the femoral head and neck.

At operation, a tibial-peg shelf was placed above the superior portion of the right acetabulum. No cast was applied, since there was no change in the position of the hip as a result of the operation, the tibial pegs being firmly impacted in the ilium.

Three weeks after the operation, the patient was allowed to walk with crutches and, after six weeks, with a cane. As a roentgenogram showed, the grafts were in position and united. Two and one-half months after operation, the patient resumed work. She had no pain, but there was some weakness in the hip.

CASE 5. A. Z., a girl, aged fourteen years, was admitted to the Clinic of the Home for Destitute Crippled Children with a pathological dislocation of the hip. She complained of a short left leg with a limp. Following an acute illness at the age of two and one-half years, an abscess in the region of the left hip had drained for about two months. A subtrocchanteric osteotomy had been performed when the patient was seven years of age.

Examination upon admission to this Clinic revealed a positive Trendelenburg sign and a prominent, high trochanter, with approximately normal range of motion. There was three and one-half inches of shortening. (See Figure 7-A.)

As the patient was already fourteen years of age and the shortening was marked, an epiphyseal arrest of the lower femoral epiphysis and upper tibial epiphysis was done on

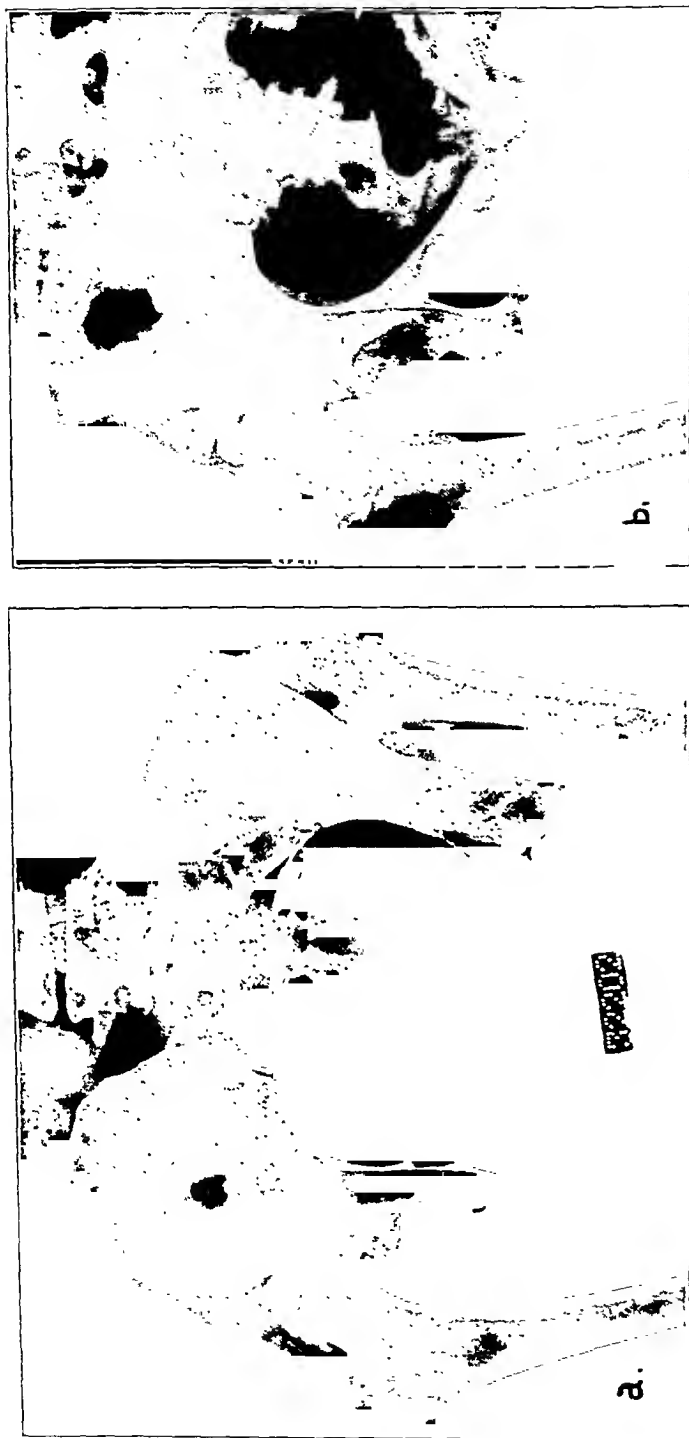


FIG. 6-A

Case 4. M. W., female, aged twenty-five, bilateral dislocation.

Fig. 6-A. The left hip has been subjected to one closed reduction and two open operations. There is almost complete destruction of the head of the femur and some atrophy of the shaft. A secondary acetabulum has formed on the right and this is bordered by a dense zone of sclerosed bone. There is some flippage of the inferior margin of the head of the femur.

FIG. 6-B

Fig. 6-B. Tibial-peg shelf thirteen days after operation.



FIG. 7-A



FIG. 7-B



FIG. 7-C

Case 5. A. Z., female, aged fourteen, pathological dislocation of the left hip. The result of an acute pyogenic infection at the age of two and one-half years.

Fig. 7-A. Shows loss of femoral head and intertrochanteric angulation, presumably the result of an osteotomy at the age of seven years. The trochanter is displaced upward onto the ilium.

Fig. 7-B. Appearance three weeks after tibial-peg-shelf operation.

Fig. 7-C. Seven months after the operation. Tibial grafts have fused together forming an arched roof against which the fragment of the neck is wedged. Motion in this hip is approximately 75 per cent. of normal in all directions, and the hip is stable.

August 4, 1933. A Steinmann pin was passed through the left lower tibia and traction was applied with the Roger Anderson well-leg splint. It was possible to pull the head of the femur down about one centimeter. The tibial-peg-graft operation was performed September 6, 1933.

The hip is stable, the range of motion is almost normal, and there is no pain upon motion or weight-bearing. Trendelenburg sign is positive, due to the weakness of the gluteus medius, but the patient is now able to abduct this leg actively against gravity.

#### SUMMARY

A tibial-bone-peg shelf was constructed in fourteen cases of congenitally dislocated or inadequate hips and in five cases of pathological dislocations resulting from pyogenic coxitis.

The material is too limited and the time since operation in most cases too short to judge well the end results. This shelf has certain advantages and disadvantages over the shelf turned down from the ilium.

It creates a more firmly anchored and a heavier shelf than that made from the ilium. Wright extension or pin or wire fixation of the femur to the cast is not necessary. The periods of immobilization and confinement to bed have been materially shortened and upward displacement of the shelf has not come about.

The range of motion has not been all that could be desired, but, on the average, it has been about as great as that obtained after the iliac-shelf operation.

It is a more formidable operation than that of creating an iliac shelf and necessitates two incisions. However, if one operating team removes the grafts while another exposes the hip, reduces the dislocation, and prepares the field, the time is reduced to approximately that required for constructing an iliac shelf, and the procedure does not produce any appreciable amount of shock.

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# SHELF OPERATION TO RELIEVE PERSISTENT DISLOCATION OF THE HIP

## A REPORT ON RESULTS \*

BY FRANK R. OBER, M.D., BOSTON, MASSACHUSETTS

*From the Children's Hospital, Boston*

Shelf construction to relieve persistent dislocation of the hip has been done at the Children's Hospital in twenty-six cases during the past eleven years. Six of these operations were for dislocation resulting from sepsis, with and without destruction of the femoral head. One of these six cases was a bilateral dislocation following pneumonia; from one hip there was a discharge of pus. Twenty operations were for congenital dislocation and in eight of these cases the condition was bilateral. The youngest patient was three years and ten months of age and the oldest eleven years.

In the earlier cases no attempts were made to secure a better position of the femoral head before operation. In most of them from one to four manipulations were done before open operation was considered. In nearly every instance the operator noted that the closed reduction was unsatisfactory.

### *Operative Technique:*

In the beginning the shelf was constructed by turning down flaps from the side of the ilium over the head of the femur, making a generous covering. These flaps were held down by a large graft from the upper end of the tibia. Later on, a good-sized piece was removed from the iliac crest and wedged into the ilium just over the shelf. Some of the Staff used a piece from the upper end of the femoral shaft and inserted this into a groove just above the shelf.

At a later date traction was used with the idea of minimizing shortening, at first with Buck's extension and counter-extension, later by Bristow's method and still later with Hoke's well-leg plaster method. About a year ago we began using Anderson's well-leg traction splint with the idea of getting the head opposite the acetabulum. Although this scheme has been used for only about a year, it has been the most satisfactory method of traction up to date.

Formerly it was not the custom to open the capsule, but, during the past four years, we have opened the capsule in practically every case, in order to explore the joint thoroughly. It has been found that the capsule may be adherent to the femoral head, may have an hour-glass contraction, or may cover the acetabular cavity, as Dr. Kidner pointed out in a paper before the American Orthopaedic Association; or there may be a

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester, Minnesota, June 7, 1934.

dense fibrous band covering the lower third of the cavity or an elongated ligamentum teres. If any one of the above conditions is present, there is sufficient reason for the head to dislocate, because it can never be completely reduced. In addition, we may have a shoal acetabulum filled with fibrous tissues. Quite frequently, in removing constricting elements, one is surprised to find that the acetabulum is quite deep. Sometimes, however, it is shown that, although it is deep enough to hold the head, the circumference of the entrance is too small. All of these conditions result in giving practically a shoal acetabulum and it seems logical that, unless these conditions are changed, there is a good chance that the head of the femur may absorb from a degenerative process, or the upper rim of the new shelf may become shoal as a result of the pressure. In one case where there had been a shoal acetabulum and considerable disability from pain, muscle spasm, and limitation of motion, the superior articular surface of the head showed complete degeneration of the cartilage. The lower third of the socket was blocked off by a dense fibrous band in the capsule, which was sufficient to keep the head from completely engaging in the acetabular cavity.

#### *The Immediate Postoperative Treatment:*

In the earlier cases a long plaster spica was applied with the leg in 25 or 30 degrees of abduction. Later it became our custom to apply traction for two or three weeks, following this treatment by the use of a long spica. This spica was worn for eight or ten weeks and then shortened for weight-bearing. In four cases in which weight-bearing was allowed in a short spica, there were subperiosteal supracondylar fractures of the femur due to slight falls, but it was found that no fractures took place when the patient walked for two or three weeks in the long spica. After two weeks of walking, physiotherapy was begun and a short plaster spica was worn.

In every case where the shelf was constructed without pulling the head down, there were a Trendelenburg sign and an abductor limp which are distressing to the patient, the parents, and the surgeon. The best explanation for this limp is that, the head being high, there is not enough function from the gluteus medius to secure normal stability of the hip. In an effort to combat this limp, we have lately been transplanting the trochanter, with its attached muscles, down on the shaft of the femur. The results of this maneuver are not known as yet. In several cases there was a marked anteversion of the head. No effort was made to correct this at the time of operation, and in every instance it disappeared almost wholly or enough so that it did not interfere with rotation. In one-half of the cases treated, the shelf partially or wholly disappeared leaving the head in its original position.

*Explanation:*

The reason for the disappearance of the shelf in so many cases is not quite clear, but in some instances it may be attributed to the following:

1. Poorly constructed shelf.
2. Shelf not constructed of acetabular tissue.
3. Failure to remove obstruction in or about the acetabulum.
4. Persistence of the Trendelenburg sign, which is due to lack of normal muscle control of the gluteus medius and also loss of power in the gluteus maximus, resulting in abnormal function of the hip-joint elements.
5. Failure to pull the head down to its normal position.
6. Development of degenerative arthritis with resultant destruction of the newly constructed acetabulum.
7. No answer can be made as to why the shelf has not disappeared in all the cases.

## CONCLUSIONS

1. In children the Trendelenburg sign persists even though a suitable shelf is apparent when constructed with the hip *in situ*.
2. The shelf should be made from acetabular tissue when possible,—that is, the shelf should be at the upper part of the acetabulum with the roof turned down and the cartilage intact. The roof should be nearly horizontal.
3. The head of the femur must be pulled down in order to construct such a shelf.
4. All obstructing tissue should be removed but, since there are degenerative processes occurring from a misshaped head, it would seem unwise to remove much fibrous tissue from the acetabular cavity.
5. If there have been two failures to secure manual reduction in young children, it would seem sound to do an open reduction before the acetabular roof disappears.
6. In spite of the fact that the shelf has melted away in many of these cases, the hips are more stable than when there is no good false acetabulum or no acetabular roof present.

# THE SCHANZ SUBTROCHANTERIC OSTEOTOMY FOR IRREDUCIBLE DISLOCATION OF THE HIP \*

BY F. J. GAENSLER, M.D., MILWAUKEE, WISCONSIN

Among palliative operations for irreducible dislocation of the hip, the Schanz subtrochanteric osteotomy has much to commend it. It is becoming popular in Europe not only for this condition, but also for allied conditions, especially ununited fracture of the neck of the femur.

While osteotomies for old dislocations have been performed previously by many surgeons, following Kirrmisson in 1891, the mechanical principles underlying the Schanz operation, as well as the details of the technique, justify the attachment of his name to the operation to be described. Schanz's osteotomy differs from the bifurcation operation of von Baeyer and Lorenz in that it is not a bifurcation, the osteotomy is located at a point corresponding to the lower level of the pelvis, a predetermined degree of angulation is sought, and, finally, this predetermined angle is maintained during the healing period by means of special screws. That careful control of the fragments is necessary to avoid serious malalignment after osteotomy was pointed out by Brackett in 1912 in a roentgenographic study of end results following osteotomy for various hip-joint deformities. Some of the conditions shown in the illustrations of his article would pass for the results of good bifurcation operations at the present time.

## INDICATION

The indication for this operation is instability with pain and fatigue of disabling severity. However, each case must be decided on its own merits with due consideration to age, occupation, and social status. Unsightly gait and lordosis should weigh less heavily in deciding on operation than pain and fatigue. In the literature there is noted a disinclination to perform the operation on patients under fifteen years of age because of occasional loss of angle, attributed by some to the pull of the abductors. Since severe symptoms rarely develop before the age of fifteen, operation need rarely be considered prior to this age.

Schanz's trend of thought in devising his operation is described in his original article in 1922 as follows: If a patient with a unilateral dislocation be asked to take a step forward with his sound leg, the following observations may be made: The step begins with the lifting of the heel, the bending of the knee, and the dropping of the pelvis on the sound side,—the Trendelenburg phenomenon. The pelvis sinks until the lower rim of the pelvic funnel impinges upon the femur. Not until this impinge-

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester, Minnesota, June 7, 1934.

ment takes place is the conversion of the pelvis and the femur into a weight-bearing unit complete, and not until then can the toes be raised from the ground and the foot advanced. The step may be divided, therefore, into two phases: a first, or dead phase, with effort wasted; and a second, or active phase, serving progression. Elimination of the dead phase by conversion of the pelvis and the femur into a weight-bearing unit at the moment the step begins should result in better performance. This can be accomplished by osteotomy and angulation in such a manner that the upper fragment applies itself to the oblique wall of the pelvis while the distal fragment lies parallel to the long axis of the body. The result of Schanz's first trials exceeded his expectations. There was marked improvement in gait, while pain and fatigue were greatly dimin-

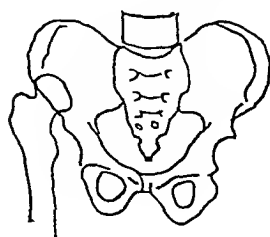


FIG. 1-A

Relation of pelvis and femur during weight-bearing on both legs.

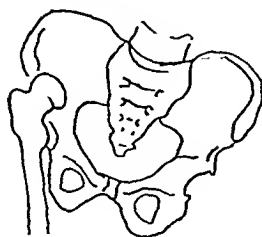


FIG. 1-B

Sinking of pelvis during advancement of the sound leg.

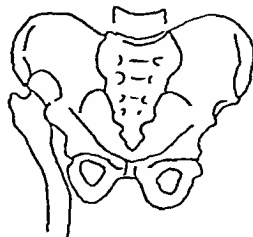


FIG. 1-C

Pelvis finding support on the proximal portion of the shaft after Schanz osteotomy.

ished. The accompanying illustrations show the relation of the pelvis and femur during weight-bearing on both legs (Fig. 1-A), the sinking of the pelvis during advancement of the sound leg (Fig. 1-B), and the pelvis finding support on the proximal portion of the shaft, thus rendering further sinking on the opposite side impossible (Fig. 1-C).

#### TECHNIQUE

The roentgenogram taken with the affected leg in maximal adduction assists in the determination of the site of the osteotomy, as well as of the degree of angulation. The site corresponds to that point on the film at which the femur lies closest to the lower pelvic rim, while the angle corresponds to that formed by the upper portion of the adducted shaft and the long axis of the body. The term "subtrochanteric" is slightly misleading since the osteotomy is not done directly beneath the trochanter, but at some distance below, as just indicated.

With the patient on the fracture table and a sand bag under the affected hip, the femur is exposed through a properly centered lateral incision. Holes are then drilled at right angles to the shaft,—one above and one below the site of the proposed osteotomy, leaving a sufficient working space of about six centimeters between them. Into these two drill holes long special screws are now introduced to serve as indicators

of the degree of angulation and as control levers. The femur is then divided transversely and angulated inward until the screws cross one another at the previously calculated angle. A protractor, or a piece of stiff tinfoil cut to the proper angle, will serve as a guide. The wound is then closed in layers. The screw ends project from the wound and are incorporated in a large double plaster spica which includes the opposite extremity to the knee. In order that fixation might be further insured, Riedel devised a metal plate to engage and immobilize the screw ends and, consequently, the fragments during the application of the plaster. It is also of advantage to insert the screws not perpendicularly, but at such obliquity that after the proper angulation they emerge from the wound parallel to each other. Instead of a simple transverse osteotomy, a notched osteotomy has been made to allow firm engagement of the fragments.

While the technique just described was carried out in most of the author's cases, in a few instances, where engagement of the fragments seemed adequate, the screws were dispensed with. It is felt, however, that the technique should be followed carefully in order to secure proper angulation and to avoid malposition.

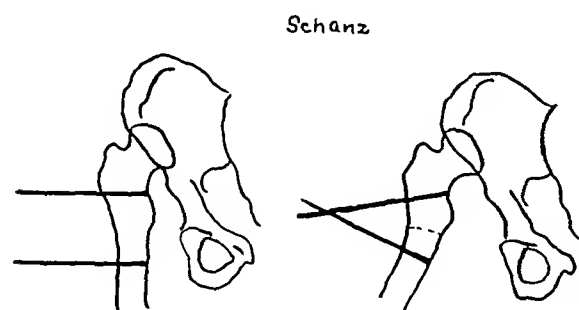


FIG. 2

Subtrochanteric osteotomy (Schanz). Fragments controlled by Schanz screws.

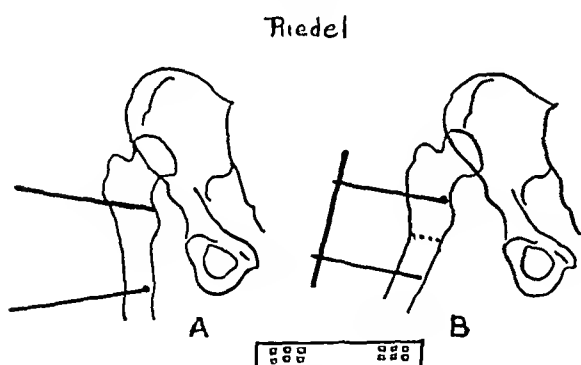


FIG. 3

A. The oblique insertion of screws (Riedel) allows greater working space than when screws are introduced perpendicularly to the shaft, as in Fig. 2.

B. Shows screws parallel after angulation of femur and securely fixed by use of the Riedel plate which is shown in the insert.

a window in the cast. The double plaster spica is retained for a period of eight weeks. The total period of treatment covers from four to four and a half months. Early physiotherapeutic measures are instituted. Slight elevation of the shoe may be desirable to offset some of the shortening of the limb; there is no objection to this since further upward riding of the femur is prevented by the relatively firm support against the lateral wall of the pelvis.

#### AFTER-TREATMENT

After four or five weeks, the screws are removed through

## ADVANTAGES

The advantages claimed for this method in common with the bifurcation method are: (1) safety and simplicity; (2) improved stability and a diminished limp as shown in the correction, partial or complete, of the Trendelenburg sign; (3) diminished lordosis; and (4) freedom from pain and fatigue.

## DISADVANTAGES

Some limitation of motion is not unusual, especially in flexion and adduction, but this is less than that following the bifurcation operation after which more or less stiffness is not infrequently recorded. Certainly, if actual bony support for the acetabulum is provided by the inner prong in the bifurcation, this must also contribute in a measure to limitation of motion, especially in cases in which the head is more or less secure in a new socket. As Lance has pointed out, two points of relative fixation—the head and the tip of the projecting prong—must, of necessity, result in considerable limitation. The shortening also must be greater in the bifurcation operation since, in addition to the angulation, there is the necessary overlapping in the attempt to thrust the inner prong into the acetabulum near its upper margin. It is conceded that the abduction of the lower fragment compensates for this to a considerable degree, so that patients are sometimes surprised to find the leg apparently longer than before the operation.

In the Schanz operation, the improved stability appears to be due in part to the improved efficiency of the glutei which are put under slight tension through the depression of the trochanter, as well as to the improved leverage conditions which favor the glutei,—the support of the femur being applied in part even medial to the normal site of the acetabulum, thus increasing the power arm of the glutei very materially. In addition, there is the frictional support derived from the contact of the adducted upper fragment with the side of the pelvis. Dahs and Schwarz, in a recent publication, point out that, in the interest of stability and in the effort to diminish lordosis—at least in the posterior dislocations—it is a distinct advantage to direct the angle not only inward, but also forward in order to give the pelvis support at a point as far anterior as possible. This appears logical and, in reports on the shelf operation, as well as on the bifurcation operation, attention has been called repeatedly to the desirability of the forward displacement of the head or of the angle of the osteotomy. While the author has not made it a point to secure anterior angulation, lateral x-rays in several of his cases show considerable anterior angulation, obtained unwittingly and due apparently to a pull of the psoas on the upper fragment.

Speaking generally, Schanz states that the results obtained from his



operation and from the bifurcation operation are not greatly at variance. In the successful cases, both result in elimination of the Trendelenburg sign and both *can* result in a gait which even to the trained eye appears almost normal. He states further that such favorable results are not obtained in all cases with either operation.

In general, the author can subscribe to the claims made for this operation so far as pain and fatigue are concerned. However, in his cases the limp, while improved, was still quite evident and the Trendelenburg test even in the most favorable cases was at least suggestive. Cases differ greatly, some being much better than others and for reasons which are not always clear.

#### COMPLICATIONS

The following complications may be mentioned:

1. *Knock knee.* This may become annoying to a degree requiring supracondylar osteotomy. Sometimes, as Schanz states, a moderate degree of genu valgum may exist prior to operation, but this is apt to become more apparent and even accentuated after operation. In one of the writer's cases a supracondylar osteotomy was done simultaneously with the Schanz osteotomy. In another case it may prove needful because of gradually developing knee strain.

2. *Non-union.* This condition has not occurred in the author's series, but three cases have been recorded in the literature (Galland, Sitenka). Careful control of the fragments, as described, should prevent its occurrence.

3. *Limitation of motion.* While limitation of motion in certain directions is the rule, more severe degrees, amounting to stiffness, may occur as in one of the author's own cases. This is more to be feared following the bifurcation operation.

4. *Splintering of bone,* endangering vessels and nerves, resulting from attempt at fracture after incomplete division of the bone. Complete osteotomy should obviate this. While marked splintering, due to faulty technique, occurred in one of the writer's cases no circulatory disturbance was noted and absorption of the fragment was well under way even six months after operation.

5. *Loss of angle,*—that is, gradual straightening of the angulation. Cases have been reported in children under fifteen years of age. The pull of the abductors has been held responsible. The author has not observed this, however.

6. *Excessive angulation* and, therefore, inability of the patient to assimilate the marked abduction. This was troublesome in one case of bilateral dislocation, complicated by an osteo-arthritis, and was relieved only after later excision of the head.

7. *Stiff knee.* This is a possibility in all cases requiring immobilization in plaster and can usually be avoided by the use of proper physiotherapeutic measures.

DISCUSSION

*The "High" Versus the "Low" Osteotomy*

Since there appears to be some confusion in the literature regarding the low as compared to the high osteotomy, a word may be in place here. In congenital dislocation of the hip only the low osteotomy, just described, is to be considered, since support of the pelvis (the paramount issue) can be provided only by the application of the adducted upper fragment to the side of the pelvis. On the other hand, in ununited fractures of the neck of the femur and allied conditions, with the head in the socket, the high



FIG. 4-A

FIG. 4-B

Trendelenburg test.

Fig. 4-A. Test positive; patient standing on right leg, the side of the dislocation.

Fig. 4-B. Test negative; patient standing on sound leg. Note that the difference between Fig. 4-A and Fig. 4-B is not very striking.

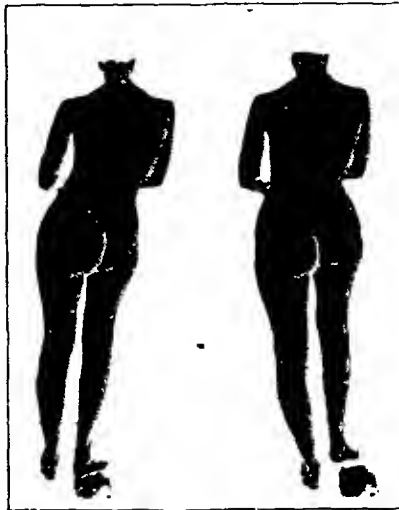


FIG. 5-A

FIG. 5-B

Gluteal efficiency test. Same patient as in Figs. 4-A and 4-B. Block under short leg to level the pelvis.

Fig. 5-A. Patient standing on right leg, the side of the dislocation, attempting to raise the left sole from the floor without bending the hip or knee. Notice marked list of the body to the right, showing that the glutei are inefficient.

Fig. 5-B. Patient standing on sound leg. The sole of the right foot is raised clear of the block. Notice the absence of list, showing that the glutei are efficient. The gluteal weakness is more strikingly demonstrable than in the Trendelenburg test.

osteotomy is indicated, provided that the distal fragment of the neck can be so placed as to provide an underpinning for the head and, therefore, an elimination of the sheering action at the fracture site. This is not always possible. In those instances in which there is marked upward riding with the fracture surfaces completely slid by one another, the mechanical conditions are analogous to congenital dislocation. There is no possibility in this type of fracture of making the head a part of the weight-bearing unit. The presence of the head in the socket is of no moment; it is disregarded and a low osteotomy is, there-



FIG. 6

Showing end result after low Schanz osteotomy for congenital dislocation of the hip.

fore, done as for congenital dislocation. In those cases, however, in which there is limited upward riding and partial apposition of the fracture surfaces, the mechanical conditions are entirely different. Here there is a possibility of utilizing the head as a part of the weight-bearing pillar, provided that a foundation can be placed under it. In this type of fracture the high osteotomy in the mid-trochanteric region, with or without wedge excision and marked internal angulation, may result in the establishment of such mechanical relations that the weight-bearing line passes through the head and strikes the fracture surfaces almost at right angles. In not a few cases of non-union of long standing, late bony union has been reported, although good functional results have been achieved even in the absence of actual bony union.

#### *Results of the Use of the Schanz Osteotomy*

This operation has been done by the writer and his associates, Dr. Schumm and Dr. Blount, in nine cases comprising twelve old congenitally dislocated hips. In three of these cases both hips were operated upon, while in two other cases of bilateral dislocation only one hip was

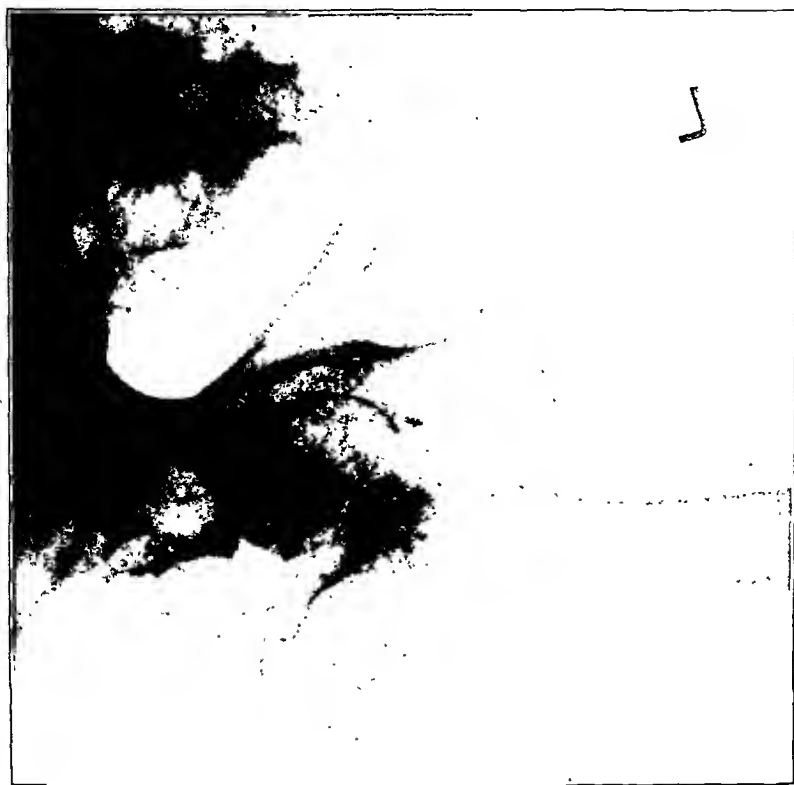


FIG. 8

Same patient as in Fig. 7 after high Sehanz osteotomy for united fracture of the neck of the femur. Note that the realignment avoids the shearing effect.

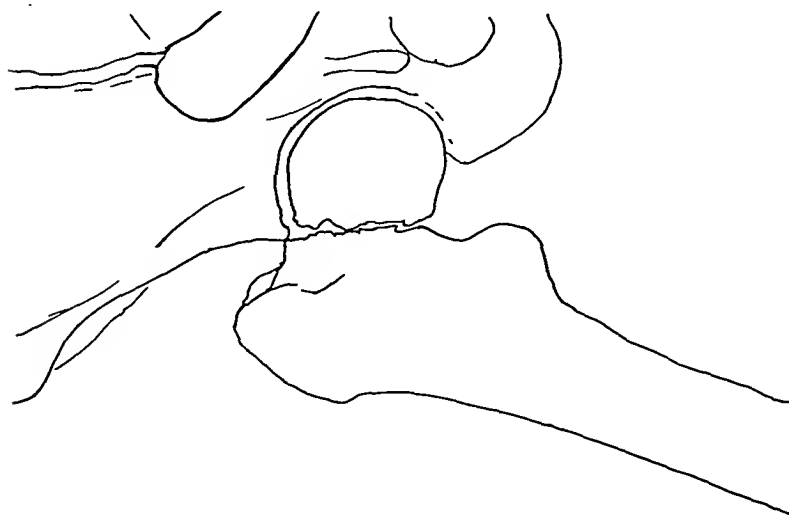


FIG. 7

Fracture of the neck of the femur. Non-union.



Fig. 9

Ununited fracture of the neck of the femur. A low Schanz osteotomy was done. Roentgenogram shows the screws still in place.

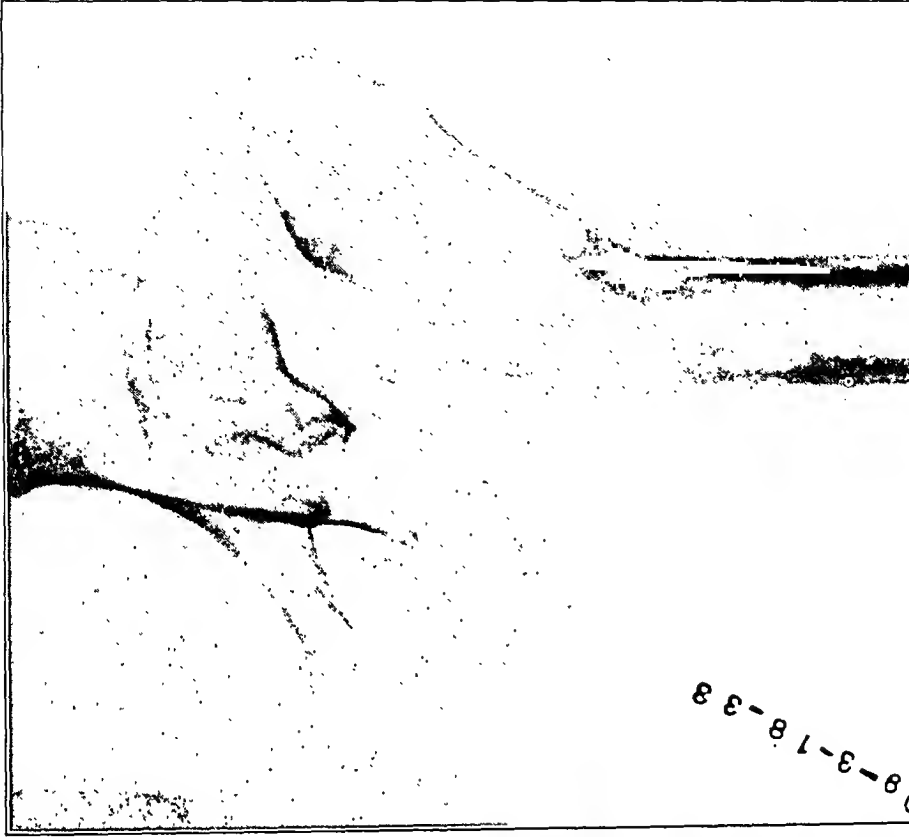


Fig. 10

Same patient as in Fig. 9 after low Schanz osteotomy. Result very satisfactory. Patient walks without pain or fatigue, although with a moderate limp.

operated upon. The operation has also been used in eleven additional cases for other conditions, principally ununited fractures of the neck of the femur. This makes a total of twenty-three operations. There have been no deaths and no infections.

The following remarks apply to congenital dislocations only: Of the nine patients operated upon one could not be located for later review. The average age of the other eight patients was twenty-four years, the oldest being thirty-eight and the youngest fifteen. All were females.

As regards motion, it may be stated that flexion was diminished in about half the cases. This is to be expected if anterior angulation accompanies internal angulation. In two cases the diminution in flexion was sufficient to prevent the patient from lacing the shoe or climbing the stairs, the latter activity requiring at least 50 degrees of flexion at the hip. In one of these cases, the diminution in flexion was clearly due to the anterior angulation. Abduction was increased on an average of 12 degrees in this series, while adduction was diminished on an average of 22 degrees. The changes in rotation are not worthy of note. The additional shortening averaged 2.3 centimeters. Excluding one case in which the head of the femur was excised and in which the shortening was 6.5 centimeters, the average additional shortening was 1.7 centimeters. The more perpendicular position of the neck after osteotomy accounts for this relatively slight increase in shortening.

In regard to the Trendelenburg test, it must be confessed that some difficulty has been experienced in classifying the cases as either positive or negative. This is due to the fact that the dropping of the pelvis does not tell the whole story. If the angle of osteotomy is sufficiently great, the pelvis may be supported at or even above the horizontal, but it is held there by the bony brace rather than by the glutei. It is believed that gluteal power may be tested more satisfactorily in the following manner: The patient stands bearing the weight equally on the two legs, the short leg being blocked up to level the pelvis. He is then asked to lift the sole of the foot from the floor without flexing either knee or hip. If he is unable to do so with the body erect—that is, without a body lunge—the opposite glutei are inefficient. Bilateral gluteal inefficiency presumably accounts for the difficulties following bilateral operation in cases of double dislocation. In the normal individual the glutei raise the pelvis on alternate sides to allow advancement of the non-weight-bearing leg. In cases of unilateral dislocation, with a Schanz osteotomy, the pelvis sinks until it finds support on the angulated femur, but it is promptly raised by the efficient glutei of the opposite side to the high level or to a position of potential from which it may again drop. Without the rise there can be no succeeding drop. Progression is, therefore, possible with little difficulty as long as there is a regular alternation of rise and fall. When both hips have been operated upon the bilateral gluteal inefficiency prevents the lifting of the pelvis on either side and gait is seriously affected.

Based on the symptoms and signs described, the results were con-

sidered good in five cases, fair in two, and poor in one. The poor result was obtained in the case of a girl weighing over 200 pounds, whose hips showed arthritic changes which were more marked in the right hip than in the left. The result after the first operation was so good that the patient was desirous of having the opposite hip operated upon also. Due, possibly, to excessive abduction and, in part, to the defects resulting from the deforming arthritis, the result after the second operation had to be classified as poor. In the four unilateral cases the results were all good. In one bilateral case in which one side only was operated upon, the result was also good. In fact, in this case the hip which was not operated upon showed considerable improvement, as far as pain and fatigue were concerned, because the patient relied to a greater extent upon the osteotomized side.

Perhaps no far-reaching conclusions are permissible from this rather limited number of cases, but it seems fair to state that in the unilateral cases sufficient relief from symptoms was afforded to satisfy the patient and to justify the operation. In the bilateral cases, in which the symptoms are sufficiently marked to demand treatment, the author's course for the present, and until the mechanics of the situation is better understood will be to proceed with great caution, operating first on the side presenting the most severe symptoms, angulating somewhat less than in the unilateral case to avoid difficulty in bringing the legs together in the event of a subsequent operation on the opposite side, and, finally, avoiding excessive anterior angulation through more careful control of the fragments.

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# OSGOOD-SCHLATTER DISEASE AND PATELLA PARTITA

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In the last two decades, a very large number of papers dealing with osteochondritis juvenilis in many situations have appeared in the literature. A number of most interesting observations have been made. The condition has been shown to occur in almost every epiphysis in the body and examples of multiple lesions, either "generalized" or showing involvement of only a few epiphyses, have been described.

One important observation was that, in several instances, osteochondritis of an epiphysis which formed one component of a joint was associated with changes in other parts of the joint. This idea is reflected in the literature by the use of the term "osteochondritis" of a joint (hip, metatarsophalangeal, etc.).

In the case of the upper femoral epiphysis (Legg-Perthes disease), not only is the femoral epiphysis affected, but changes occur also in the acetabulum, the adjacent part of the diaphysis, and, at times, in the trochanter. In addition to the bony changes demonstrated by the roentgenogram, microscopic investigation has shown alterations in the synovial membrane of the joint.

Similar involvement of several bones has been noted in the second metatarsophalangeal joint, the shoulder joint, and the knee. In the knee joint, the bone most obviously and frequently involved is the patella (Larsen-Johansson disease). Concomitant changes in the lower femoral epiphysis usually have been either overlooked or regarded as of little importance. Nevertheless, the association of this condition with osteochondritis of the tuberosity of the tibia (Osgood-Schlatter disease) has been discussed by a number of writers.

In several cases, <sup>5,7,8,10,12</sup> this association has been observed in the same limb and, in others, <sup>2,4</sup> the patella of one side and the tuberosity of the tibia of the other were found to be involved. This association is too frequent to be dismissed as a coincidence.

On the other hand, patella partita has been shown to have some relationship to osteochondritis. Meisels <sup>6</sup> has described osteochondritis in a bipartite patella. That there is some relationship between the partite patella and osteochondritis is indicated by cases such as those of Fleischner <sup>2</sup>, Hackenbroch <sup>3</sup>, and others, and probably also by those cases described by Büttner <sup>1</sup> and those referred to by Siemens <sup>11</sup>. These writers <sup>1, 11</sup> have described cases in which patella partita was associated with bone changes which were probably the late results of a process of the same kind as osteochondritis juvenilis.

The following case is reported in order to place on record another example of the association of patella partita and Osgood-Schlatter disease.

J. D., male, aged ten years, complained of pain over the anterior tuberosity of the left tibia of two weeks' duration. He had been doing some jumping at school, but did not remember any special injury.

On examination, there was a tender swelling in the region of the left tibia. The knee was normal. The right tibia and knee joint were also clinically normal.

Roentgenographic examination of the right knee showed: *lateral view* (Fig. 1), the typical appearance of Osgood-Schlatter disease; *anteroposterior view* (Fig. 2), a tripartite patella. The left knee was normal.

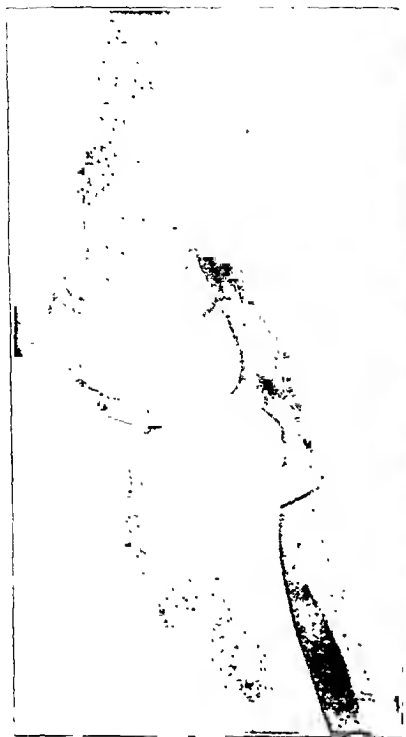


FIG. 1

Lateral view of right knee, showing appearance of Osgood-Schlatter disease.



FIG. 2

Anteroposterior view of same knee, showing the condition of the patella.

Patella partita is an anomaly of the bone which is not infrequently observed, and in most cases there is no obvious association with other bone disorders. Most of them are discovered, however, because the symptoms have persisted after other conditions, particularly those of the osteochondritis type, would have healed.

Recently it has been suggested<sup>13</sup> that patella partita is a condition which predisposes to the development of osteochondritis, but this does not take into account those cases referred to which show other coincidental lesions of bone. It seems more probable that the change in the patella is the result of processes similar to those occasionally occurring in osteochondritis in other parts of the skeleton, and in which the return to

normal is in some way atypical. At the present time, it is useless to postulate possible causes for the condition. Many more observations are necessary before any deductions of real value can be made.

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# A STUDY OF THE HEALING OF ONE HUNDRED CONSECUTIVE PHALANGEAL FRACTURES\*

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The following report is based upon a study of 100 consecutive fractures which came under our observation in the Western Electric Company Hospital, at its Hawthorne Works in Chicago.

The object in making this study was to determine, primarily, the length of time required for complete bony healing of phalangeal fractures as demonstrated in the roentgenograms, and to determine the disposition of separated fragments of bone, which are commonly seen in crushing injuries. An effort was also made to determine the relationship between clinical healing and ultimate roentgenographic healing.

In this series, fractures are divided into:

- A. Transverse or splitting fractures
  - 1. Distal phalanx
  - 2. Middle phalanx
  - 3. Proximal phalanx
- B. Chip fractures
  - 1. Tip of distal phalanx
  - 2. Interphalangeal joints

Subdivision was then made into:

- 1. Complete fractures
- 2. Incomplete or fissure fractures
- 3. Ununited fractures
- 4. Badly lacerated and comminuted compound fractures, in which group infection and devitalization of tissue played an important part in the ultimate results.

Simple fractures in which there was some open laceration or perhaps exposure of the bone were not strictly classed under 4, because of the fact that these were at once converted into closed fractures and progressed satisfactorily as such.

The majority of these patients were men. The occupations were so varied that it is impossible to classify these fractures from an occupational standpoint. All types of accidents, from baseball injuries to punch-press accidents were represented. Most of the toe injuries, however, were direct results of weights dropping on the toes.

Approximately 50 per cent. of these phalangeal fractures, including all types, were immobilized with tongue-depressor splints. Approximately 15 per cent. were treated by adhesive strappings to the adjoining digit. Three of them were treated with plaster splints. The others were simply bandaged or received no dressings at all.

\* Presented at the Clinical Conference of the American College of Surgeons, Chicago, Illinois, October, 1933.

All compound fractures were given immediate surgical attention, the major portion of which was directed to the repair of the skin and soft tissue. All cases in which there was devitalization of soft tissue or gross contamination with dirt were carefully debrided and, when relatively clean, were treated with suitable antiseptics and immediately converted into closed fractures.



FIG. 1-A

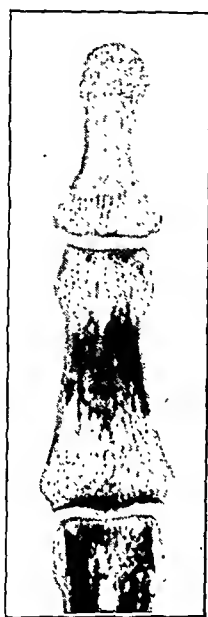


FIG. 1-B



FIG. 1-C



FIG. 1-D

January 24, 1931

February 24, 1931

April 27, 1931

May 25, 1931

CASE 1 illustrates a typical fracture through the proximal third of the distal phalanx. The fracture line is quite distinct one month after the injury. Three months after the injury, the fracture line is much less distinct, and there is a slight amount of callus on the lateral side. Four months after the injury, the fracture line is no longer discernible and the external callus has largely absorbed.



FIG. 2-A



FIG. 2-B



FIG. 2-C



FIG. 2-D

Case 2. March 2, 1931

March 9, 1931

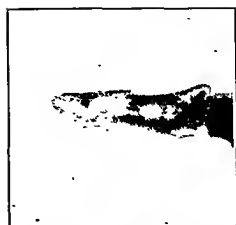


FIG. 2-G      FIG. 2-H  
April 28, 1931



FIG. 2-E



FIG. 2-F

March 25, 1931

CASE 2 illustrates a transverse, somewhat oblique fracture through the middle of the distal phalanx. Three weeks after the injury, the fracture line is much more marked. In this case it was suggested that non-union was present.

Fig. 2-E and Fig. 2-F demonstrate a complete lack of false motion at the fracture site on bending of the phalanx.

Roentgenograms taken at one-month intervals show the progress of the healing, with very little callus evident.

Fig. 2-K and Fig. 2-L. Roentgenograms, taken approximately five months after the injury, show the fracture line essentially obliterated by new bone.

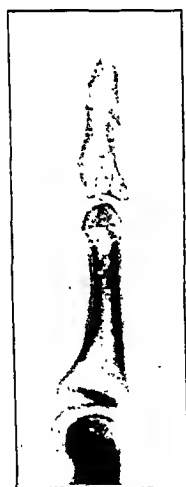


FIG. 2-I



FIG. 2-J

May 25, 1931



FIG. 2-K



FIG. 2-L

June 26, 1931

In many of the cases there was a very badly contused distal phalanx. Whenever possible the nail was left in place but, if there was an accumulation of blood beneath the nail, a small drill hole was made for drainage.



FIG. 3-A



FIG. 3-B



FIG. 3-C



FIG. 3-D

April 17, 1931

May 15, 1931

Roentgenograms showing a diagonal splitting fracture of the distal phalanx.



FIG. 3-E



FIG. 3-F



FIG. 3-G



FIG. 3-H

June 17, 1931

August 4, 1931

September 17, 1931

October 16, 1931

Roentgenograms showing the progressive healing of the fracture as it fills in with new bone from within outward. There was complete healing at six months.

If the nail was badly lacerated or partly torn, it was removed. It is always advisable to preserve the nail whenever possible as it acts as a natural splint.

Reduction of the transverse fractures was made in all cases in which it was necessary. This was particularly true of those of the middle and proximal phalanges. In no case was it necessary to use traction.\*

Tongue-depressor splints were employed, as above stated, in about half of the cases. Although often they were not necessary for fractures in the distal phalanges, they were used for protection. Splints were kept on for about two weeks; in a few cases, of course, it was necessary to keep the splints on for a longer period of time. This was found to be especially true in the cases of so called "baseball finger". This injury is characterized by a fracture of the dorsal articular facet of the distal phalanx at which point the extensor tendon is inserted. In the roentgenogram this small fragment of bone appears to be somewhat insignificant; neverthe-

\* There undoubtedly are cases in which traction is essential, and it is not intended to convey the impression that the principle of traction is not favored; it so happened that no such cases are included in this particular series of cases.



FIG. 4-A  
March 16, 1931



FIG. 4-B  
April 17, 1931



FIG. 4-C  
June 16, 1931



FIG. 4-D  
July 12, 1931

CASE 4 illustrates a typical fracture through the distal third of the middle phalanx. It is seen that this fracture line disappeared progressively until ultimate healing occurred four months after the injury.

less, it is accompanied by an inability to extend the distal phalanx and, if allowed to go on in this condition, it is accompanied by a permanent drop joint. If such a case is treated on a small splint with the distal phalanx in hyperextension for at least thirty days, the results are very much better.

Internal fixation was used in only one case,—that of a bad compound fracture of the proximal phalanx of the index finger, which was complicated by a tendon injury and nearly complete severance of all the soft tissues. In this case, the bone ends were approximated and held by one heavy, chromic catgut suture placed through a drill hole in the bone on either side of the fracture site. This case was observed over a period



FIG. 5-A  
November 30, 1930



FIG. 5-B  
December 15, 1930



FIG. 5-C  
April 20, 1931



FIG. 5-D  
July 27, 1931

CASE 5 illustrates a case in which there was some angulation noted after two weeks and in which ultimate healing was not demonstrated until after eight months.





Fig. 6-A

May 28, 1931



Fig. 6-B

CASE 6 illustrates a typical fracture of the proximal phalanx.

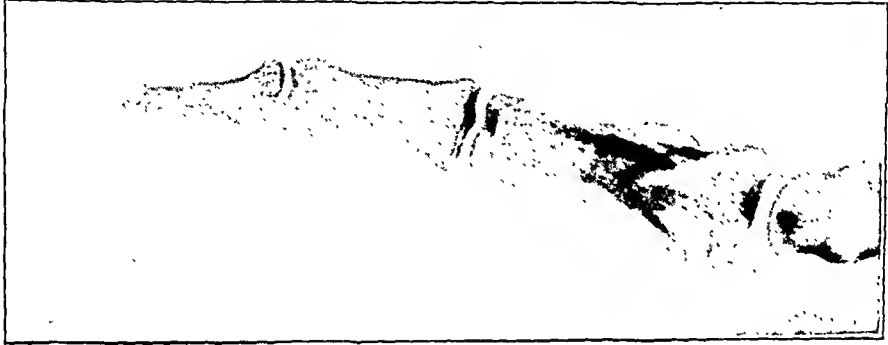


Fig. 6-C

June 29, 1931



Fig. 6-D

In this case, rather heavy callus was seen at the end of the first month.

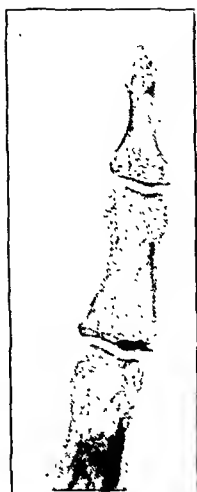


FIG. 6-E



FIG. 6-F



FIG. 6-G

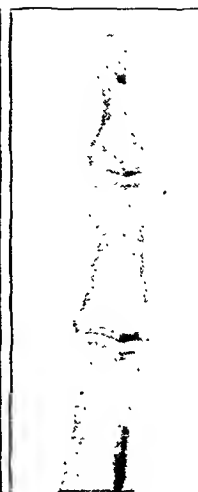


FIG. 6-H

August 3, 1931

December 21, 1931

The callus had largely disappeared at the end of the third month, and at the end of the seventh month there was practically a normal restoration of contour of the phalanx.

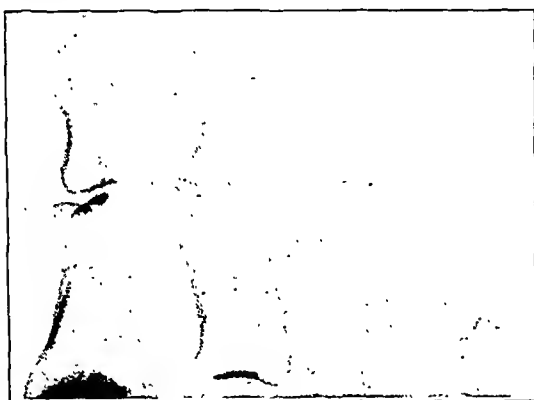


FIG. 7-A

Case 7. April 21, 1931



FIG. 7-B

May 6, 1931

of twelve months; at the end of that time, there was complete obliteration of all evidence of fracture. This patient was dismissed as being clinically healed in three months, with a 50 per cent. loss of function, due to stiffness of the two joints distal to the fracture; the same amount of disability persisted over a period of two years.

Table I shows the types of cases included in this study and the average length of time required for bony healing, as demonstrated roentgenographically and clinically.

It will be seen from Table I that the time for clinical healing is much less than the time required for the appearance of solid bony union in the



FIG. 7-C



FIG. 7-D

July 9, 1931



FIG. 7-E



FIG. 7-F

September 11, 1931

Fig. 7-A and Fig. 7-B. Roentgenograms showing a fracture of the proximal phalanx of the great toe.

Fig. 7-C, Fig. 7-D, Fig. 7-E, Fig. 7-F. Showing the progressive healing over a period of four and one-half months.

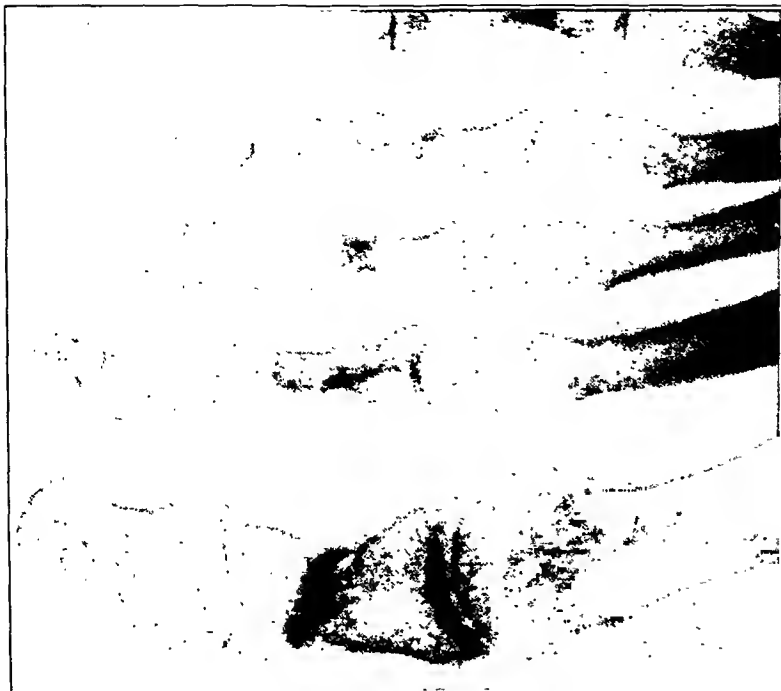


FIG. 8-B

November 14, 1930



FIG. 8-A

August 26, 1930

CASE 8. These roentgenograms illustrate a fracture of the three proximal phalanges of the foot, each showing a different healing time.



Fig. 8-C

December 17, 1930

In these roentgenograms healing of the second toe at the end of four months is evident.

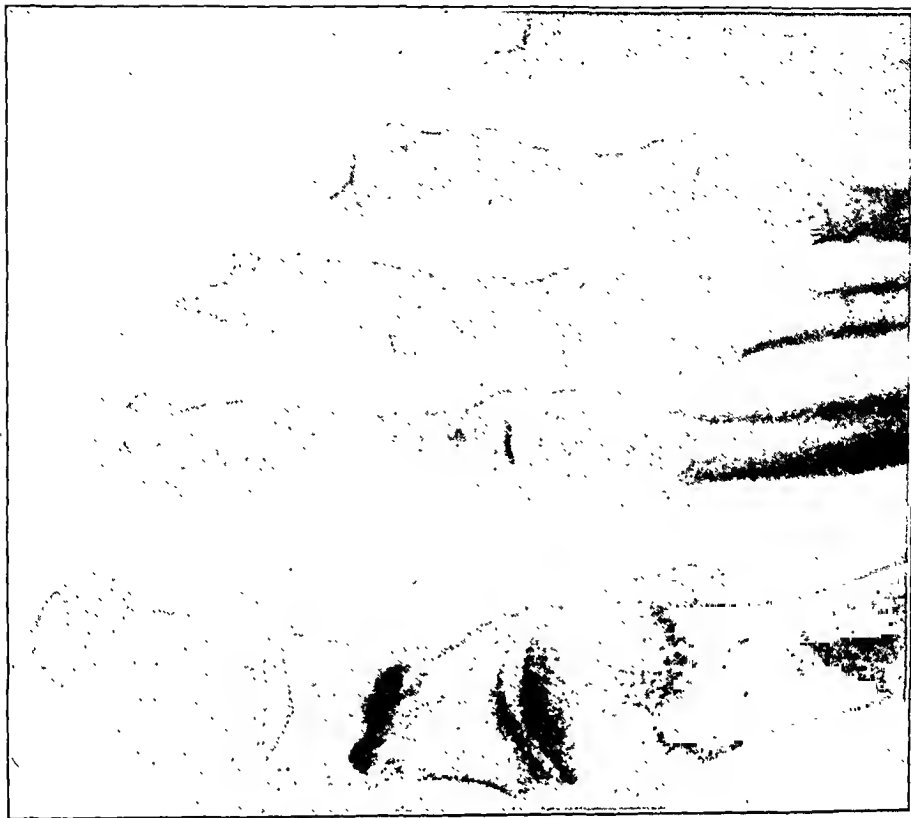


Fig. 8-D

January 16, 1931

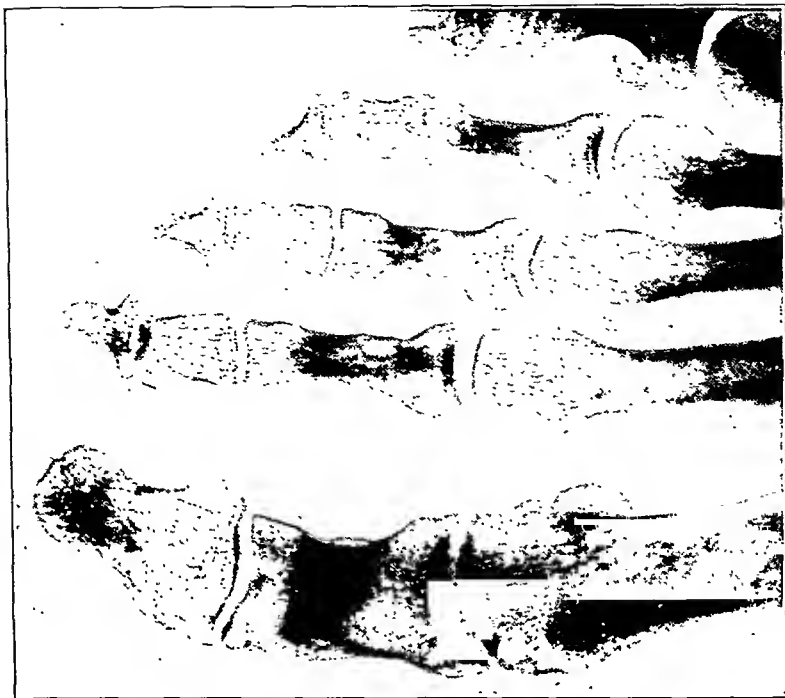


FIG. 8-F  
March 17, 1931

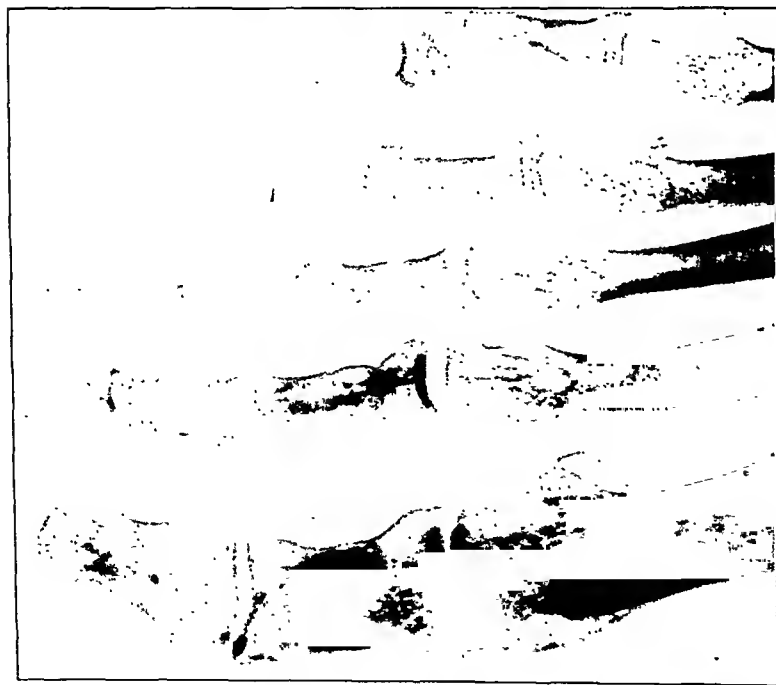


FIG. 8-E  
February 17, 1931

Showing the healing of the third toe at the end of five months, and of the great toe at the end of the seventh month.



FIG. 9-A

November 25, 1930



FIG. 9-B

December 29, 1930

CASE 9 illustrates a typical fracture at the tip of the distal phalanx.

Fig. 9-A. In the roentgenogram taken at the time of the accident, it is difficult to make out the extent of the fracture at the tip of the distal phalanx.

Fig. 9-B. Roentgenogram, taken a month later, shows the crushed egg-shell-like fracture extending around the entire tip of the phalanx.



FIG. 9-C

February 27, 1931

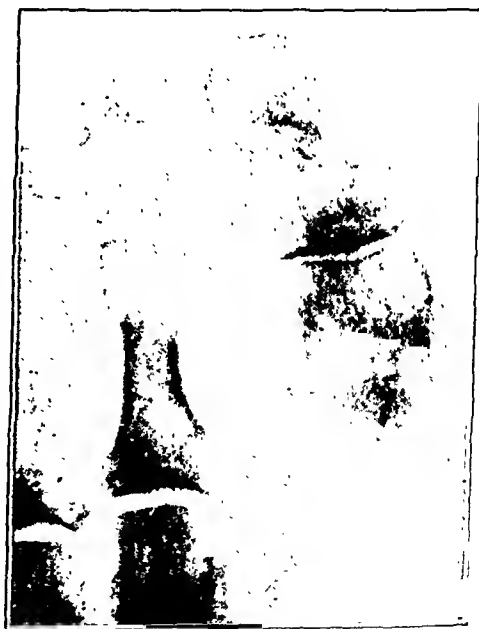


FIG. 9-D

May 5, 1931

Fig. 9-C, taken three months after the injury, still shows the loose fragments, although they are not quite as clear-cut.

Fig. 9-D, taken five and one-half months after the injury, shows a complete bony union.

This case is typical of many of the crushing injuries at the end of the toe or finger, and corresponds with the average time for their healing.



FIG. 10-E  
December 29, 1931

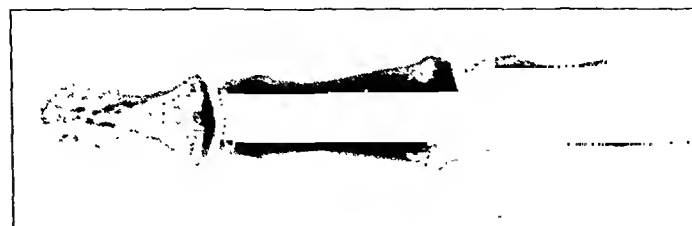


FIG. 10-D  
October 28, 1931

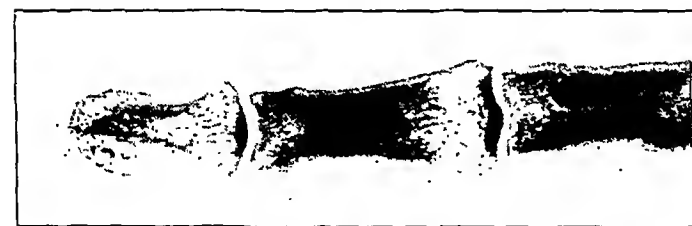


FIG. 10-C  
August 28, 1931

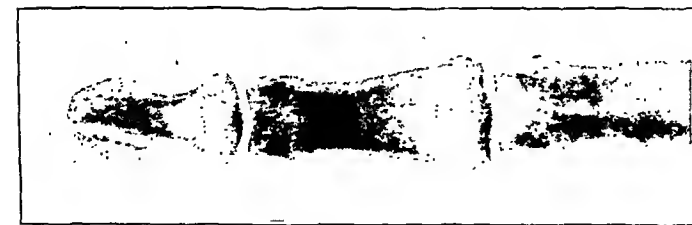


FIG. 10-B  
April 16, 1931

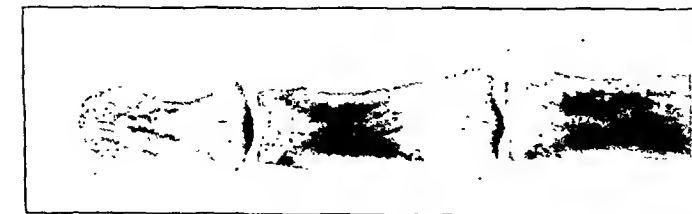


FIG. 10-A  
February 13, 1931

CASE: 10 shows a case in which a considerably longer time was required for bony healing,—i.e., ten and one-half months. Again it is to be noted that the fracture line two months after the injury is more pronounced than in the original roentgenogram. In this case, no new bone was seen in the fracture line until six months had elapsed, and the visible defect was not entirely obliterated until after ten and one-half months.



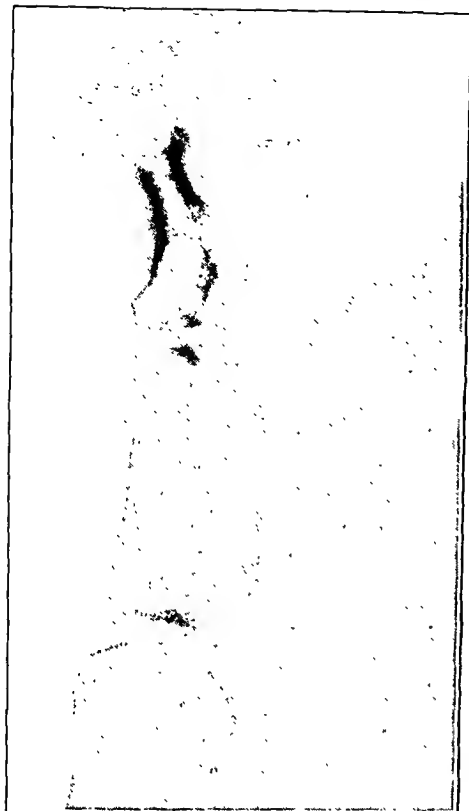
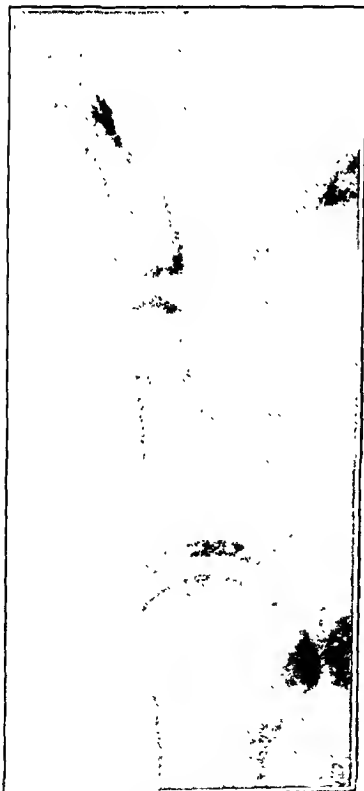


FIG. 11-A



FIG. 11-B

Case 11. October 17, 1930

FIG. 11-C  
December 9, 1930FIG. 11-D  
January 9, 1931

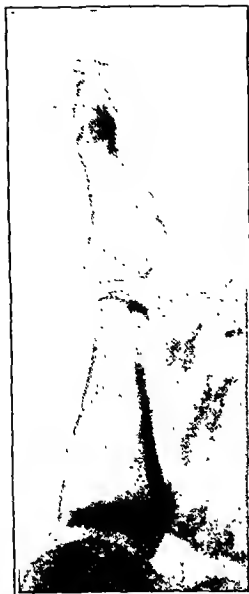


FIG. 11-E

May 6, 1931



FIG. 11-F



FIG. 11-G

July 8, 1931



FIG. 11-H

December 10, 1931



FIG. 11-I

CASE 11. Fig. 11-A and Fig. 11-B show a very severe crushing injury. Besides the injury at the tip, there was also a chip fragment knocked off near the base of the phalanx.

Fig. 11-D. It is interesting to see how distinct these fragments are at the end of three months.

Fig. 11-E, Fig. 11-F, and Fig. 11-G. Roentgenograms showing how, as time goes on, the fragments at the tip seem to contract to reform the normal contour of the finger.

Fig. 11-H and Fig. 11-I. Roentgenograms showing that all the fragments have united, except one large fragment at the tip, which projects downward into the soft tissues.

This case was x-rayed again at the end of eighteen months, and no change was found over that seen at the end of fourteen months. This is one of the cases that was considered a non-union.

roentgenogram. The time for clinical healing was arrived at by computing the number of weeks which elapsed from the time of

injury to the time when the patient was able to return to his former occupation and was, therefore, dismissed from further clinical observation.

It is noteworthy that the healing time by x-ray evidence was considerably less in the incomplete or fissure fractures than in any other type,



FIG. 12-A

November 22, 1930



FIG. 12-B

December 23, 1930



FIG. 12-C

February 23, 1931



FIG. 12-D

April 23, 1931

CASE 12 illustrates a case of a chip fragment in the distal joint. This fragment, although small, is distinctly seen for the first three months. At the end of five months it has entirely reunited to the phalanx.



FIG. 13-A

November 17, 1930



FIG. 13-B

March 17, 1931



FIG. 13-C

July 9, 1931



FIG. 13-D

October 16, 1931

CASE 13 shows a small chip fragment at the flexor surface of the middle joint. It seems to be much more distinct four months after the injury, and it is still evident eight months after the injury. At the end of eleven months, it has completely reunited to the phalanx.

This case is presented to show that in some of these small chips a much longer period of healing time is required than in the average phalangeal fracture.

TABLE I  
TIME REQUIRED FOR HEALING OF FRACTURES

Type and Location of Fractures	Complete Fractures			Incomplete Fractures			Ununited Fractures			Compound or Infected Fractures			Total Cases
	No.	By X-Ray Evidence (Months)	By Clinical Evidence (Months)	No.	By X-Ray Evidence (Months)	By Clinical Evidence (Months)	No.	Months Observed	By Clinical Evidence (Months)	No.	By X-Ray Evidence (Months)	By Clinical Evidence (Months)	
A. Transverse or splitting fractures													
1. Distal phalanx.....	14	5.1	.9	4	3.8	.9	0	0	0	3	10	1.8	21
2. Middle phalanx.....	5	5.2	1.5	0	0	0	0	0	0	1	7	2.0	6
3. Proximal phalanx.....	12	4.3	1.5	3	2.0	1.2	0	0	0	1	12	3.0	16
B. Chip fractures													
1. Tip of distal phalanx...	32	5.6	.9	1	5.0	1.5	2	12.5	2.3	1	5	1.5	36
2. In or around joints.....	19	4.8	1.1	1	1.0	1.0	1	13.0	1.5	0	0	0	21
Average		5.1	1.7	9	3.0	1.8	3	12.0	2.0	6	9.0	1.9	100
Total cases.....	82												

Percentage showing bony union in roentgenograms, 97 per cent.

Percentage showing non-union in roentgenograms, 3 per cent.



FIG. 14-A  
March 26, 1931



FIG. 14-B  
April 29, 1931



FIG. 14-C  
June 30, 1931



FIG. 14-D  
August 28, 1931

CASE 14 illustrates an incomplete splitting fracture at the end of the distal phalanx. One month after the injury, the fracture line was more marked than on the first roentgenogram. Three months after the injury, the fracture line had filled in from the base within a few millimeters of the tip; at the end of five months it was completely filled in with new bone. Although this is slightly longer than the average healing time for incomplete fractures, the case illustrates the way in which the fracture line fills in with new bone.

but that the time for clinical healing was no less. The last group of fractures, which includes severe injuries with loss of soft tissue and subsequent infection, required a longer period of time for healing both by clinical and by x-ray evidence. It was found that fractures of the proximal phalanges required a somewhat shorter time for healing as shown by x-ray, although, on an average, there is little difference in time required for the healing of fractures in the distal, middle, and proximal phalanges, this average being about five months.

The maximum time for healing, by x-ray evidence, of any phalangeal fracture was fourteen months; and the minimum, one month. Of the three ununited fractures, two were chip fractures in the tip of the distal phalanx, and one was a chip fracture in the distal joint. The two at the tip of the distal phalanx were found to be ununited after a period of twelve and one-half months. The one in the joint was found to be ununited after thirteen months. Clinically, these cases are healed and show no disability. It is safe to assume that, in these three cases, there is some fibrous union which does not show in the roentgenograms.

#### CONCLUSIONS

1. The average time for bony healing of complete phalangeal fractures of all types, as shown roentgenographically, is approximately five months.

2. Clinical healing requires about one-fourth of the time required for roentgenographic healing.

3. The fracture lines are usually more distinct at the end of thirty days than at the time of the injury.

4. Single or multiple chip fragments in the tips of the distal phalanges practically always reunite and give a normal-appearing contour to the distal phalanx.

5. No callus is seen in a chip fragment at the tip of the distal phalanx and there is more callus formation in the proximal phalanges.

6. In none of these cases has there been absorption of any of the loose fragments.

7. It cannot be assumed that there is a lack of bony union until at least one year's time has elapsed.

# A NEW TYPE OF RECONSTRUCTION OPERATION FOR OLD UNUNITED FRACTURE OF THE NECK OF THE FEMUR

BY PAUL C. COLONNA, M.D., NEW YORK, N. Y.

This type of reconstruction operation on the hip has been designed primarily for those cases in which non-union is accompanied by complete absorption of the femoral neck. The patients are usually able to walk only with the aid of crutches, and they complain of pain on attempted movement and weight-bearing. The limb becomes shortened, due to the upward riding of the greater trochanter, and assumes an attitude of flexion and adduction; the hip is unstable with restricted, painful movement. This reconstruction operation was, therefore, designed not only to assure stability in the case of an advanced type of ununited fracture, but also to produce a satisfactory range of movement in all directions and to lengthen the shortened extremity.

The operation has been employed in six cases during the past three years, the youngest patient being forty-eight years of age and the oldest seventy years.

The operation consists essentially of severing the muscles attached to the greater trochanter very close to their insertion to the bone, care being taken to leave a fibromuscular layer covering the region of the greater trochanter. The capsule is then divided close to the femur and the loose head fragment is removed.

After the greater trochanter has been placed deeply within the acetabulum, the abductor muscles are then transplanted downward as far as they will reach and are attached by a bony trough to the lateral surface of the shaft of the femur and are held in place with kangaroo tendon. The vastus lateralis is then carefully reefed over the transplanted abductors as shown in Figure 4.

By leaving the greater trochanter undisturbed and covered by its fibromuscular layer, freedom of movement is obtained because the cartilage of the acetabulum is opposed to a fibromuscular layer rather than to a newly constructed neck of raw bone. Leaving the greater trochanter undisturbed also has the advantage of restoring a greater or lesser amount of length to the extremity, depending upon the extent to which the greater trochanter has ridden up above the superior rim of the acetabulum. In some cases a preoperative period of skin traction has been found useful as an aid in stretching the contracted tissues.

It is essential that the abductors be securely anchored to their new insertion in order that the greater trochanter may be retained deeply within the acetabulum and that controlled abduction may later be obtained. In spite of the roentgenographic evidence of apparent insecurity following this procedure, there have been no dislocations, although it is

conceivable that, unless care be taken to anchor securely the abductor muscles to the bone, such a complication might occur. One must, therefore, assume that this stability is assured not only by the dense fascia of the thigh, but also by the secure insertion of the abductor muscles into the bone. The controlled mobility permits the patients to sit comfortably in an ordinary chair and to have a satisfactory range of motion in all directions.

Following the operation, the limb is immobilized in plaster for four weeks in from 15 to 20 degrees of abduction, complete extension, and neutral rotation. The posterior splint to the limb is then retained and overhead traction suspension is begun in order to encourage active and passive movement in bed.

#### PROCEDURE

A curved incision is made, beginning about one inch behind the antero-superior spine and curving downward and crossing the femur about five inches below the tip of the greater trochanter (Fig. 1). The fascia is divided and all the muscles attached to the greater trochanter are carefully cut near their insertion, care being taken *not to remove any portion of the underlying bone*, but to leave the upper extremity of the femur covered by a thin layer of muscle and fibrous tissue.

The superior gluteal nerve is well out of the operator's way and is in no danger of being injured.

The capsule is then opened longitudinally, after which it is divided transversely close to the greater trochanter, in order to preserve as much of the capsule as possible. The limb is then rotated outward and adducted; the upper extremity of the femur is freed by sectioning the piriformis, gemelli, and obturators close to their insertion. The loose head is then removed and the cervicotrochanteric region is inspected. If spicules of the fragment of the neck remain, they are chiseled off flush with the inner surface of the shaft and this raw area is covered over with adjacent tissue.

The most favorable type of case is that in which the neck portion has been completely absorbed, its site being occupied by dense avascular fibrous tissue.

After the greater trochanter has been completely freed of all its muscle attachments, it can be easily pulled down and placed deeply within the acetabulum. In all of the patients operated on the greater trochanter has been found easy of reduction and of a size which has permitted it to be sunk deeply within the acetabulum. The thickened capsule and abductor muscles are then pulled down, holding the limb in about 20 degrees of abduction.

The fibers of the vastus lateralis are then identified and separated subperiosteally, exposing the shaft of the femur. A bony trough is made on the lateral aspect as far down as the abductor muscles (removed from the greater trochanter) will reach when the limb is in about 20 degrees of



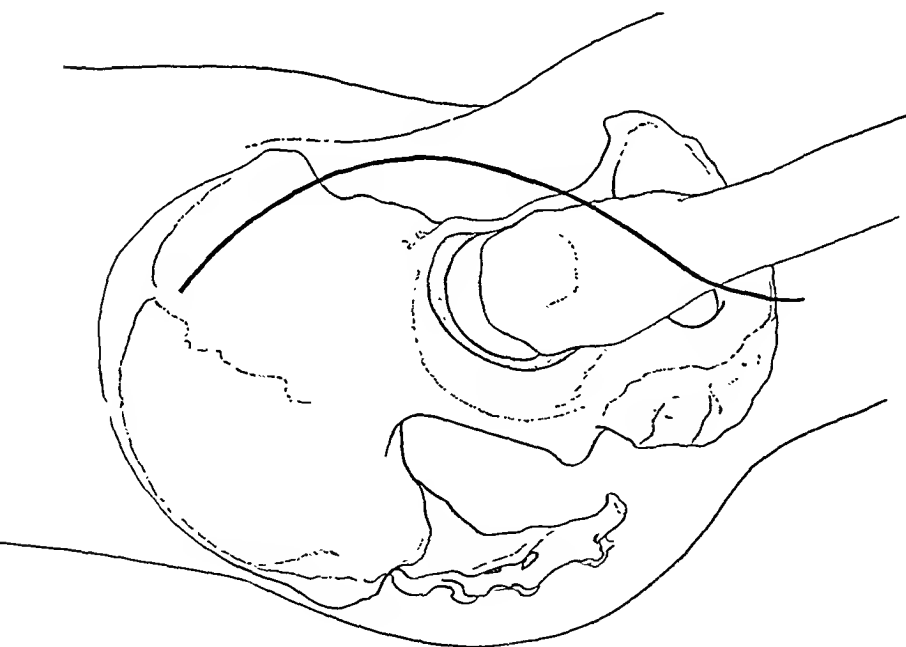


Fig. 1  
Showing type of skin incision.

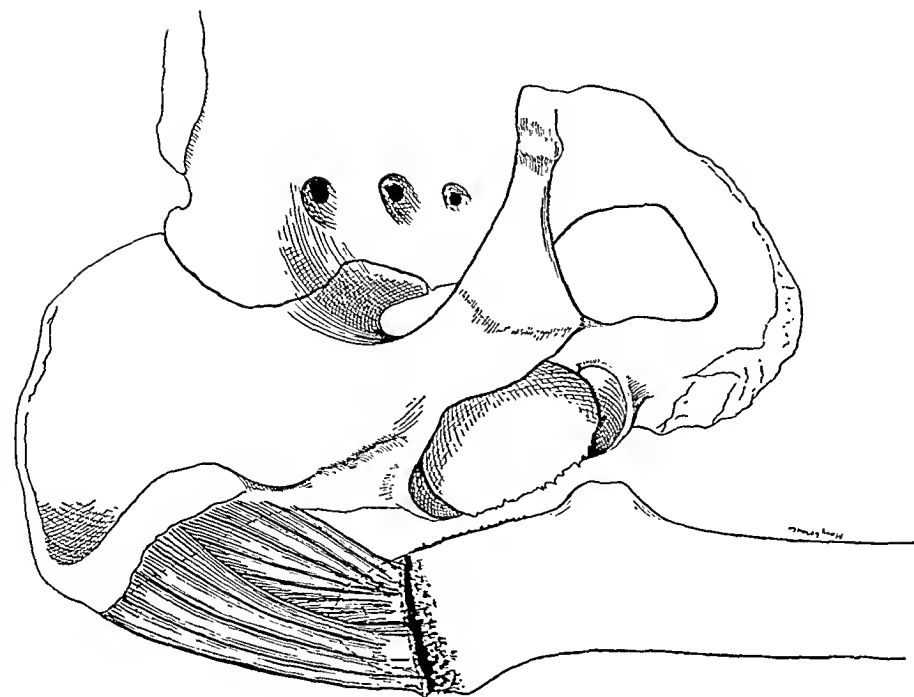


Fig. 2  
Showing the cutting of the muscles attached to the greater trochanter, leaving fibromuscular tissue covering the bone. The capsule is cut through and the loose fragment of the head is removed.

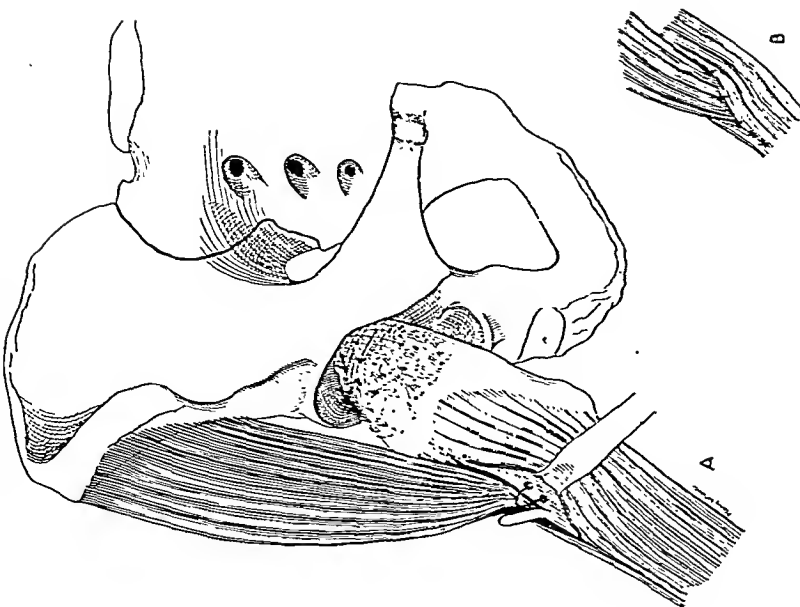


FIG. 4

The femur is pulled down and the upper extremity is placed deeply in the acetabulum. The abductor muscles are sutured in place as shown in A. The fibers of the vastus lateralis are roofer over the transplanted muscles, holding the flap of bone firmly in place, as shown in B.

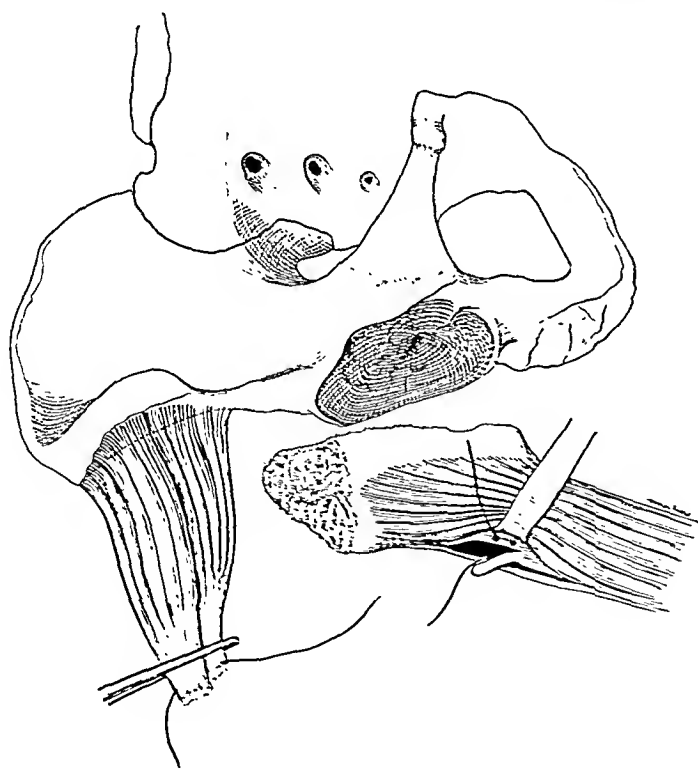


FIG. 3

The abductor muscles are turned upward. A canal is made on the lateral aspect of the shaft of the femur and kangaroo tendons are threaded through as shown.



Fig. 5-B

Case 1. Two years and nine months after operation. The upper surface of the femur has become well rounded and a definite joint space has been formed.

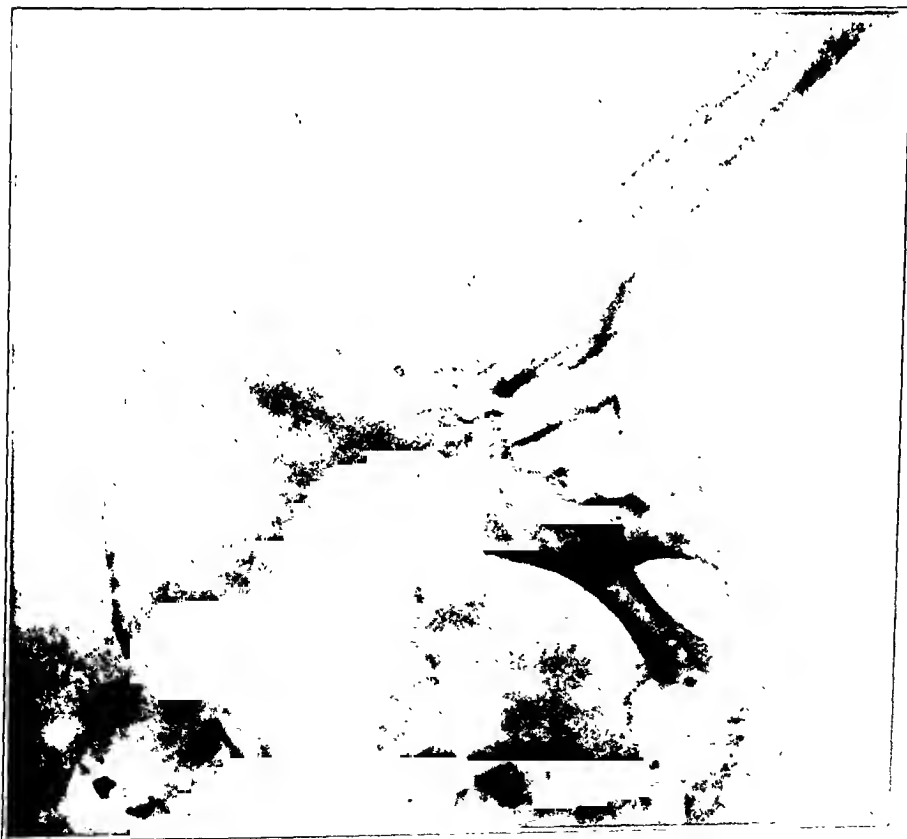


Fig. 5-A

Case 1. Before operation. Shows complete absorption of the neck and upward riding of the greater trochanter.

abduction. (See Figure 3.) Before preparing the bony flap in the shaft of the femur, care is taken to have the patella pointing upward. Two small drill holes are then made in the shaft in the anteroposterior plane; the muscles are drawn down snugly to this position and held in place by kangaroo tendon, and the bony flap is sutured over the mass. (See Figure 4.) The vastus lateralis is then carefully reefed over the new insertion of the gluteus medius and the gluteus minimus and the wound is closed in layers. A long plaster spica is applied from the toes to the axilla with the limb in about 20 degrees of abduction and in complete extension.

After four weeks the plaster is bivalved, and active and passive movements in bed are begun; these movements are made possible by an overhead swinging apparatus. The limb is held in a posterior splint with a pillow placed between the thighs to prevent adduction for the first few weeks. This swinging is continued for several weeks and is combined with baking and massage of the muscles of the thigh and hip. Eight weeks after operation the patient is usually able to walk about with the aid of crutches, and is encouraged to walk with a cane as soon as possible.

#### CASE REPORTS

CASE 1. Mrs. G. R., fifty-five years old, a housewife, slipped in August 1930, and fractured the right hip. She was taken to the hospital where roentgenograms showed a transcervical fracture of the right hip. A Whitman abduction plaster was applied and subsequent roentgenograms showed apparently satisfactory reduction. The spica was worn for six months and, at the end of that time, there appeared to be very doubtful union. The patient was, however, given a well fitting brace and was referred to the author in March 1931. At this time she was walking with the aid of a brace and crutches. She stated that she was unable to bear any weight on the limb because of pain.

Examination showed a well developed woman, unable to walk without the aid of support and presenting outward rotation of the right lower extremity with shortening of one inch and a half. There was definite telescoping present and the x-ray (Fig. 5-A) showed an old ununited fracture of the neck of the right femur with complete absorption of the neck and upward riding of the greater trochanter. Operation was advised.

The patient was admitted to Bellevue Hospital and, on April 10, 1931, a reconstruction operation of the type described was performed. The head fragment was quite loose and the neck portion was practically completely absorbed. Both the head fragment and the neck portion of the shaft of the femur were covered by dense fibrous tissue. There was no bleeding noted in the region of the ligamentum teres on removal of the head. The patient's convalescence was uneventful, and she was discharged from the hospital six weeks after operation. She stated that seven weeks after operation she was able to walk one mile and, since her discharge from the hospital, she has been doing her usual housework.

At present, three years and a half after operation, she is quite active, walks rapidly, and the limb presents three-quarters of an inch of shortening. No attempt has been made to compensate for this as it is felt that the limb in a slight degree of abduction is in a more secure position than otherwise. The patient is able to go up and down stairs, sit comfortably in a normal chair, and has a range of motion from 180 to 100 degrees and a free range of abduction. A recent roentgenogram (Fig. 5-B) shows that the upper extremity of the femur has become somewhat rounded with time and a definitely constructed joint space is noted. There can be seen the remains of the bony trough made for the insertion of the transplanted abductor muscles. Clinically the hip seems stable,

so that in this case stability, controlled mobility, and an increase in the length of the lower extremity seem assured.

CASE 2. Mr. F. M., seventy years old, fell on the sidewalk and fractured his left hip. He was transferred to the Orthopaedic Service and examination showed an old man in poor general condition with a healed decubitus over the sacrum. The left limb lay in marked outward rotation and presented one inch of shortening with non-union of the neck of the femur. The patient was unable to walk without the aid of crutches and, even with these, he walked very awkwardly and complained of severe pain on weight-bearing.

On August 11, 1932, a reconstruction operation of the type described was performed. At the end of four weeks, the plaster was removed and overhead suspension was begun. At the end of six weeks, the patient was allowed out of bed. His convalescence was slow and he was rather fearful to bear weight on the left lower extremity. He complained of stiffness about the left knee which was, therefore, manipulated under an anaesthesia with some improvement in the range of movement.

The patient was discharged in January 1933 to a country convalescent home. He walked with a cane and presented one-half an inch of shortening, with a range of motion from 180 to 150 degrees and a free range of abduction. He complained of some pain on weight-bearing, but presented a stable hip with limited amount of movement and an increase of one-half an inch in the length of the lower extremity.

CASE 3. Mr. J. B., aged sixty-eight years, was first seen in the Orthopaedic Clinic at Bellevue Hospital with a history of having fractured his right hip five years previously when he slipped on a pavement. Non-union had developed and he came to the Clinic because of pain, a limp, and severe disability. He was able to walk only a block or two even with the aid of crutches.

Examination at that time showed an elderly man, walking awkwardly with the aid of crutches and presenting outward rotation and shortening of the right lower extremity. The limb was held in a flexion-abduction attitude and abduction was completely restricted beyond the mid-line. There was an inch and a half of shortening, and movements at the right hip in flexion were possible from 160 to 140 degrees.

He was admitted to Bellevue Hospital and a reconstruction operation was done on August 9, 1933. While in plaster, the patient developed a psychosis and, after four weeks, the plaster was removed and overhead traction suspension was begun. Because of his mental condition, a short plaster spica was applied and he was transferred to the psychopathic ward.

His mental condition remained unchanged and, at the time of his transfer to a permanent psychopathic institution, he was walking without plaster and with the aid of crutches. He had a limited range of movement in all directions. The hip was painless and stable and, following operation, the length of the lower extremity had been increased by one inch.

CASE 4. Mrs. A. N., aged fifty-six years, was transferred to the Orthopaedic Service on November 8, 1932.

Examination showed frank non-union of the left femoral neck with shortening of one inch.

The operation described was performed on November 10, 1932. Her convalescence was uneventful and a month after the operation the plaster was removed and traction suspension begun. She was allowed out of bed two weeks later and presented a good range of movement in all directions. She continued to walk about the ward, first with the aid of crutches and then with a cane, and was discharged a few weeks later.

Since that time she has continued to do her housework and, in addition, has been able to return to her work as dressmaker. She prefers to use a cane when walking on the street and can get in and out of street cars easily. It has now been over a year since her

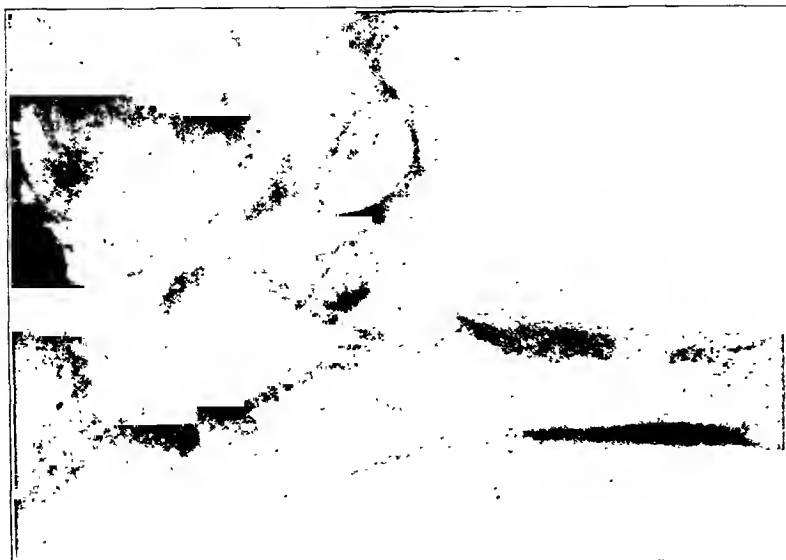


Fig. 6-B

Case 2. Three months after operation. The insertion of the abductor muscles may be seen.



Fig. 6-A

Case 2. Before operation. Note density of the fragment of the head.

8-4

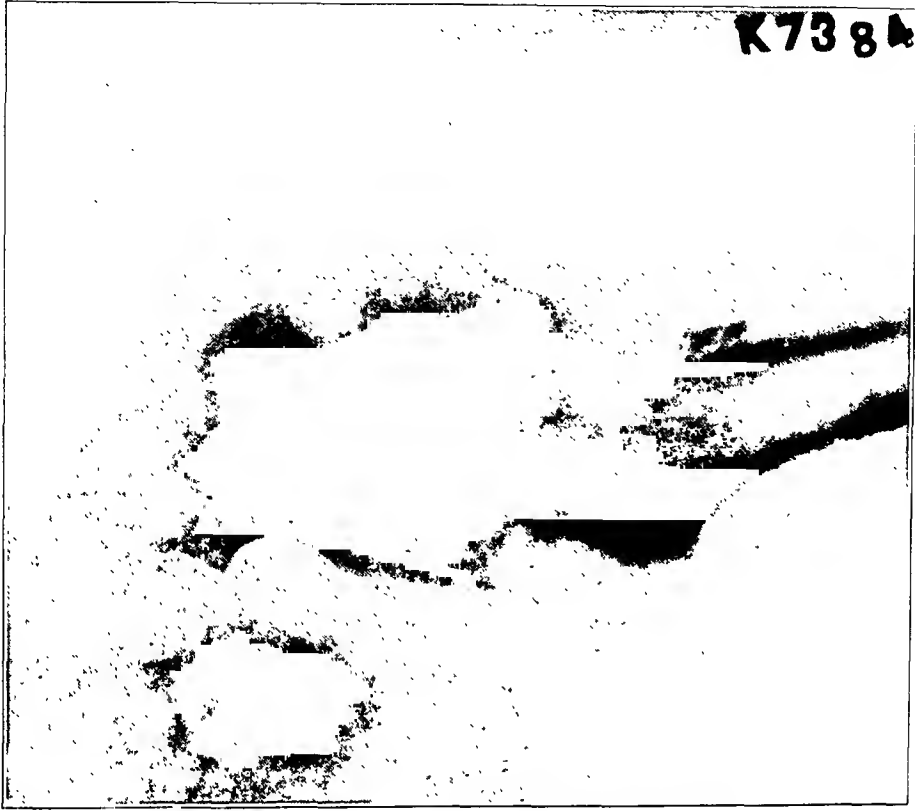


Fig. 7-B  
Case 3. Two months after operation.



Fig. 7-A  
Case 3. Before operation. Note density of the head and also the deformity and marked upward riding of the greater trochanter.

operation and a recent x-ray, taken fifteen months post-operatively, is shown (Fig. 8). Her range of movement at the present time is from 180 to 120 degrees and there is free range of abduction. There is only a quarter of an inch of shortening, which shows a gain of three-quarters of an inch.

CASE 5. Mrs. M. N., aged fifty years, was admitted to Bellevue Hospital, and the blood sugar on admission was found to be 190 milligrams. She was put on a diabetic diet and fifteen pounds of traction applied to the left lower extremity.

Examination showed a woman in poor general condition, lying in bed with the right limb in outward rotation and adduction. The right patella was noted to be on a considerably higher level than that of the opposite side. Movements could be accomplished passively in all directions, but were painful, and abduction was limited to about 10 degrees. There was noted a marked degree of telescoping, accompanied by crepitus and pain. There

was shortening of one and a half inches. This patient was practically completely disabled. She received treatment for diabetes for a week, at the end of which the urine showed 0.5 per cent. sugar and operation was advised.

On July 20, 1933, a reconstruction operation of the type described was done. The plaster was bivalved and movements were begun four weeks later.

At the present time, she is doing her housework and walking about with the aid of a cane. She states that the hip is becoming stronger, but that she occasionally has some pain, particularly in damp weather. She sits comfortably in an ordinary chair and has a range of motion from 180 to 110 degrees, with free abduction. The limb presents a half inch of shortening in comparison with the inch and a half of shortening before operation. In spite of its apparent insecurity (Fig. 9-B) the hip appears to be quite stable.

CASE 6. Mrs. R. S., aged forty-eight years, was admitted to Bellevue Hospital in October 1933.

Examination showed a woman in poor general condition, with the left limb lying in marked external rotation. She was unable to lift the heel off the bed and the left hip could not be moved without pain. There was shortening of one inch and abduction was



FIG. 8

Case 4. One year and three months after operation. The femur is held securely in place by the transplanted abductor muscles attached at a.





Fig. 9-A

Case 5. Before operation. Shows absorption of the femur and upward riding of the greater trochanter.



Fig. 9-B

Case 5. Seven months after operation. Clinically this hip is secure in spite of the roentgenographic appearance of insecurity.

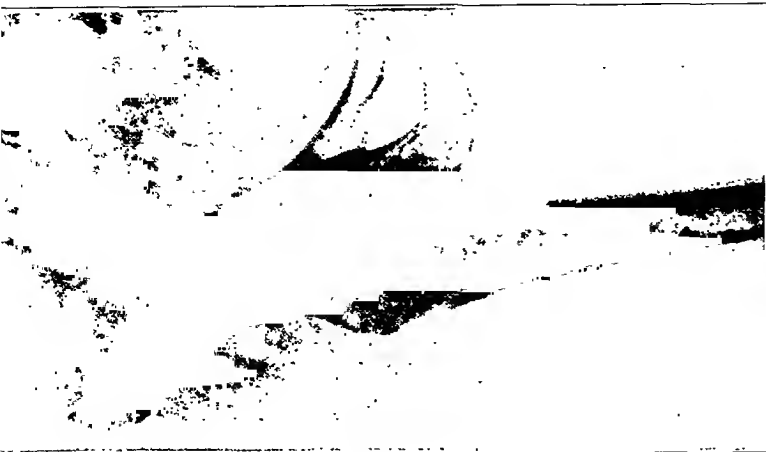


FIG. 10-C

Case 6. Two months after operation. Limb held in adduction.



FIG. 10-B

Case 6. Three months after operation. Limb in abduction.



FIG. 10-A

Case 6. Before operation. Shows necrosis of the fragment of the head and absorption of the neck.

restricted to about 10 degrees. The hip was slightly flexed and extension was restricted and painful. The roentgenogram (Fig. 10-A) shows complete absorption of the neck.

On October 18, 1933, the reconstruction operation described was done. Four weeks later movement was begun by overhead suspension, and physiotherapy to the left hip and knee was started.

On January 9, 1934, she was discharged from the Hospital, walking with crutches and presenting a painless stable hip. There was 30 degrees of flexion and a free range of abduction. (See Figures 10-B and 10-C.) Measurements showed a half inch of shortening instead of the shortening of one inch on admission. Her convalescence has continued uneventful.

#### SUMMARY

The essential features of this reconstruction operation are (1) preservation of a fibromuscular layer over the greater trochanter which is placed deeply within the acetabulum after the head fragment has been removed and (2) transplanting the abductor muscles as far down on the shaft as possible and securely fastening them to the bone.

In the six cases reported an excellent range of movement has resulted; stability has been obtained; and in all the cases there has been an increase of a half inch or more in the length of the extremity.

## EPIPHYSEAL FRACTURE-DISLOCATION AT THE ELBOW JOINT \*

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Fractures and epiphyseal separations of the lower end of the humerus are among the most common injuries of childhood. The usual varieties of traumatic injuries of the elbow are well known and respond readily to reduction manoeuvres; in most cases full function is restored to the injured elbow. There occurs a type of fracture-dislocation of the elbow joint that has escaped common recognition. The injury is followed by almost total loss of use of the elbow joint unless adequate treatment is employed.

The specific injury under consideration is a lower humeral epiphyseal separation with lateral and upward dislocation of the epiphyses from the elbow joint (Figs. 1-A and 1-B). This injury is as truly a clinical entity as fracture-dislocation of the shoulder joint, and is of more frequent occurrence than the shoulder injury. The lack of true appreciation of its nature lies in the difficulty of accurate clinical and roentgenographic diagnosis. Since only the calcified centers of ossification in the cartilaginous epiphysis are visualized by roentgenography, the roentgenologist also misinterprets the nature of the injury and, while describing the direction of displacement of the separated epiphysis, neglects to call attention to the associated joint dislocation.

Roentgenograms of thirteen cases of epiphyseal separation, or distal condylar fracture, of the lower end of the humerus, with dislocation of the distal fragment from the elbow joint, have been found in the files of the Department of Radiology of the Stanford University Hospital. Ten patients were seen in the Out-Patient Clinic of the Lane Hospital and three were private patients of members of the staff. The typical fracture-dislocation occurred in the first decade of life,—the youngest patient was five and one-half, and the oldest twelve years of age at the time of injury. The type of fall leading to the injury is accurately known from the history in only eight cases, but in each of these eight instances there was a definite history of a fall on the elbow with the forearm flexed. Three of the eight patients fell from a toy wagon or scooter on the point of the flexed elbow. One boy, in falling with the flexed forearm palm down, struck the elbow as the forearm continued to flex under the force of the fall.

Seven patients suffered epiphyseal separation of the lower humeral epiphysis with lateral, anterior, and upward dislocation of the epiphysis in relation to the upper humeral fragment and the bones of the forearm.

One boy of twelve years sustained a medial dislocation of the intercondylar epiphysis, the dislocated fragment being rotated and adducted as well as displaced from the joint.

\* Received for publication March 5, 1934.

A young adult male, aged twenty-two years, applied to the Orthopaedic Clinic for treatment of a stiff elbow. The original injury was received at the age of six years, and closed reduction was attempted at that time by his family physician. The roentgenograms of the functionless elbow revealed a healed epiphyseal fracture-dislocation of the capitulum of the type common to children in the first decade of life.

A young woman, aged twenty-five, was examined by Dr. Emmet Rixford for an elbow injury received some years previously. The elbow was ankylosed in right-angle flexion. Stereoroentgenograms revealed a posterior dislocation of the forearm, with a healed diacondylar fracture of the humerus. The condyles were displaced forward, laterally, and rotated in the direction of pronation.

An Italian laborer, fifty-three years of age, seen in the Orthopaedic Clinic, was found to have an old fracture-dislocation of the elbow of more than twenty years' standing. An accurate history could not be obtained because of language difficulties. Roentgenograms revealed an old diacondylar fracture (or epiphyseal dislocation) with anterior and upward displacement of the healed condylar fragment. The bones of the forearm were in the typical position of posterior dislocation and the elbow was ankylosed (in 100 degrees of extension) with the exception of a moderate degree of supination and pronation.

Two women, aged seventy-six and fifty-five years respectively, sustained intra-articular fractures of the external condyle of the humerus. In both instances, the condylar fragment was displaced laterally, anteriorly, and upward, with subluxation of the condyle from the articulation with the radial head.

In regard to treatment of this group of injuries, closed reduction was attempted in seven patients. In three of these cases, closed reduction was recognized as unsuccessful and complete reduction was obtained by operation.

Dr. L. R. Chandler recognized that operative reduction was imperative in the case of one boy, because of marked swelling of the arm and displacement of the fragment. The patient was operated upon by Dr. John Cowan and Dr. Chandler and a satisfactory reduction was obtained. Two other patients had open operative reduction. Three patients with old fractures gave no history of attempted reduction.

Although the follow-up records are inadequate, and although we failed to reach and examine two patients, we know of only four of these patients who recovered full and satisfactory use of the elbow without deformity. Three of these were operated upon after the closed method had failed to reduce the displacement of the fragments. In the fourth patient, adequate and complete reduction was obtained under the fluoroscopic screen. Six patients treated by closed reduction alone failed to regain function of the elbow to the extent of a useful joint. One patient failed to regain good function after operative reduction, and, four months later, flexion of the elbow was limited to 80 degrees, extension to 120 degrees, with normal pronation and supination. Check-up x-rays

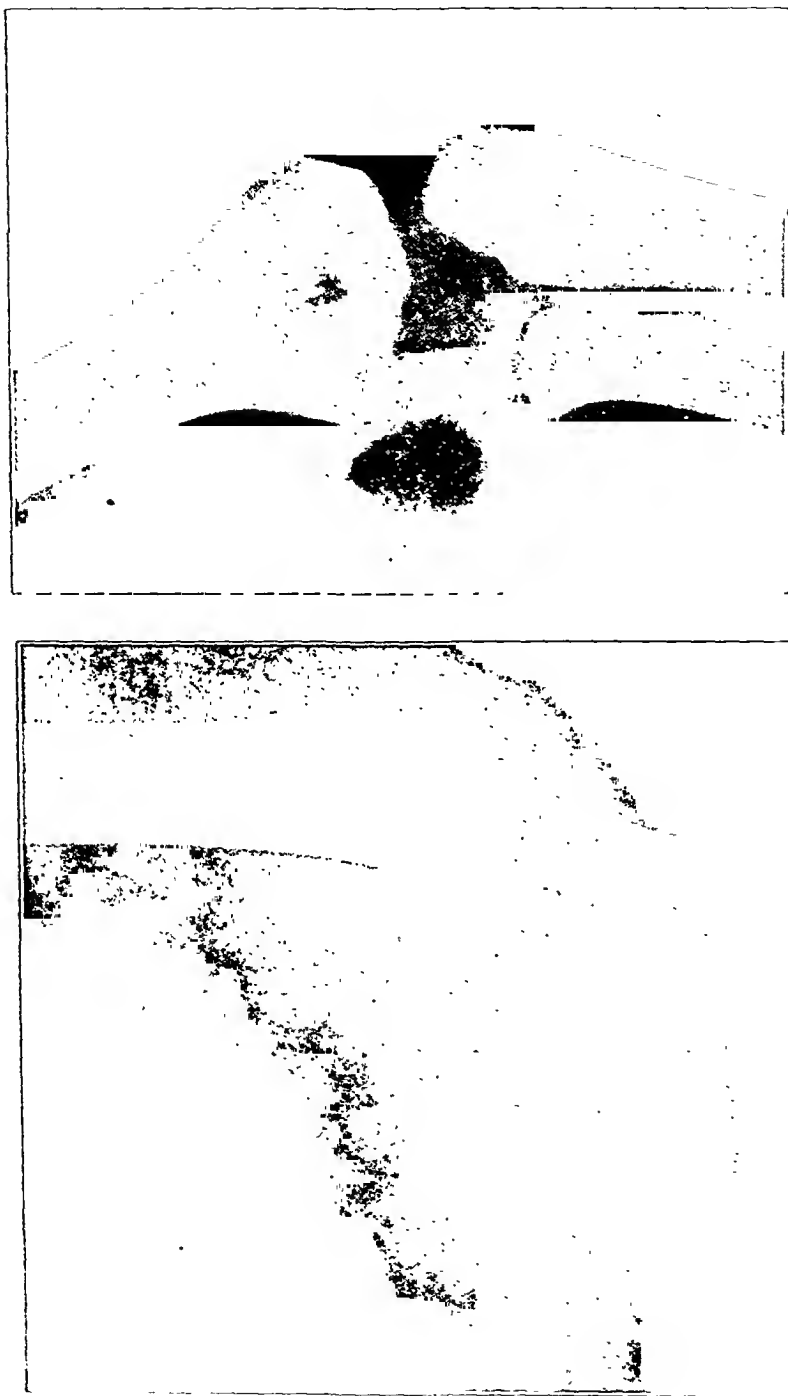


FIG. 1-A

FIG. 1-B

W. P., aged seven years. Epiphyseal separation and dislocation of the lower end of the humerus. Lateral view shows capitellar epiphysis dislocated upward from the articulation with the radial head. Anterior view shows the lateral dislocation from the joint. The trochlear epiphysis can not be seen. The bones of the forearm retain their relative positions.

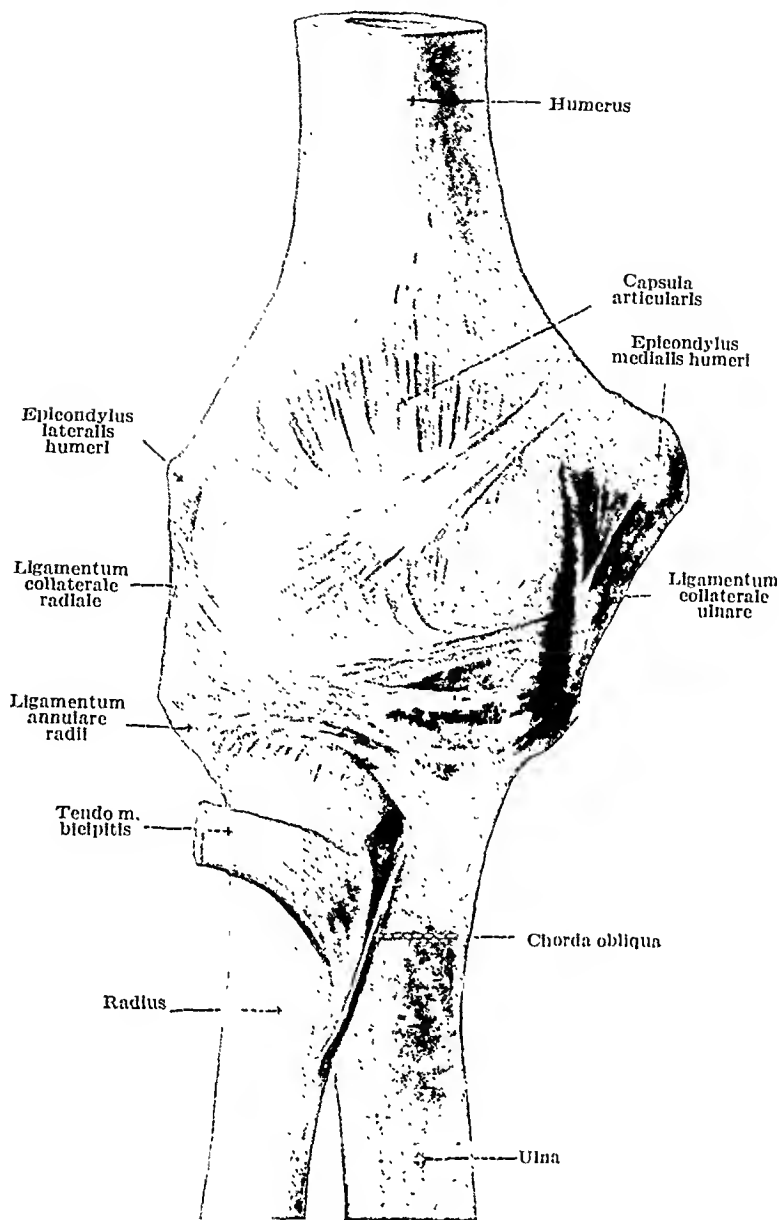


FIG. 2

The capsular ligaments of the elbow joint are weak on the lateral radial side in the region of the lateral humeral condyle. The lateral ligaments and the mid-anterior fibers form relatively strong bands. (Reproduced from "*Handatlas der Anatomie des Menschen*" by Werner Spalteholz, by courtesy of S. Hirzel.)

showed that operative reduction had not been complete. Such results argue neither for closed nor open reduction, but show strikingly that adequate complete reduction must be secured to restore good function to the injured elbow.

In the files of the Department of Radiology of the Stanford University Medical School, there are roentgenograms of 180 instances of elbow injuries since 1926. A careful study of these roentgenograms shows that supracondylar fracture of the humerus and separation of the lower

humeral epiphysis are the most common injuries encountered. Both injuries are caused by a similar mechanism and the mode of treatment is quite the same, so they may be classed together. One hundred and eight such injuries occurred, comprising 60 per cent. of the elbow injuries. There was fracture of the internal epicondyle only in forty-two instances, or 23 per cent. of the total. Epiphyseal separation, or diacondylar fracture with dislocation, occurred in 7.2 per cent., or thirteen cases. Next in order of frequency of occurrence came fracture of the external epicondyle, 3.8 per cent.; fracture of the external condyle, 3.8 per cent.; and fracture of the internal condyle, 1 per cent. The usual posterior dislocation of the elbow was seen in only two cases, or 1.1 per cent. This is in marked contrast to the statistics of Wilson who found dislocation to be one of the most frequent elbow injuries in children. This discrepancy can be explained, for the author is informed by Dr. Thomas Wiper that dislocation of the elbow is an injury frequently treated in the Emergency Hospitals of San Francisco. Such patients are sent to their own physicians or to the Out-Patient Clinics of the various hospitals for after-care. A number of our patients with fracture of the internal epicondyle have given a history of recent reduction of an elbow dislocation in the City Emergency Hospitals.

When one realizes that the epiphyseal fracture with dislocation occurs third in frequency in elbow injuries, it is apparent that a study of the mechanism, the pathological nature, and the treatment is justified and deserves wider recognition.

The action of the triceps tendon in protecting the posterior aspect of the elbow joint is fully appreciated. The broad tendon of insertion of the brachialis plays a similar and scarcely less important rôle in protecting the anterior aspect of the elbow joint.\* This is reenforced by the humeral head of the pronator radii teres. On the anterior radial aspect of the joint the protection is less certain. The function of rotation (radial humeral articulation) makes it imperative that freedom of motion be present here.

When force is applied, as in falling on the flexed elbow, the capitellum is in a position to suffer from a cross-breaking strain and, should the force continue and be sufficiently great, the capitellum is popped, as a pea from the pod, through the thin joint capsule anteriorly and laterally (Fig. 2), with the production of an epiphyseal separation and dislocation (Fig. 3). In the age groups in which this injury occurs one has no way of telling

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\* Delayed dislocation of the elbow may take place in the non-mobilized joint because of the lack of the protective presence of an intact tendon of insertion of the brachialis: posterior subluxation is thus brought about by the pull of the unopposed powerful triceps muscle.

Mr. W. E. S. sustained a fissure fracture of the head of the right radius July 21, 1934. His physician allowed the use of the arm in a sling. Later the patient noticed "clicking sensations as if bones were hitting that shouldn't". Recheck x-rays taken seventeen days after the injury showed a posterior dislocation of both bones of the forearm at the elbow. The new roentgenograms also revealed clearly a fracture of the coronoid of the ulna (brachialis insertion) which went unnoticed, although present, in the original films.



roentgenographically whether the entire epiphysis with the trochlear epiphysis has also separated, for the trochlear epiphysis has not sufficient calcification to be visualized with the x-ray until later. That the trochlear epiphysis does separate and subluxate with the capitellum is proved by operation, and herein lies the explanation for the peculiar form of

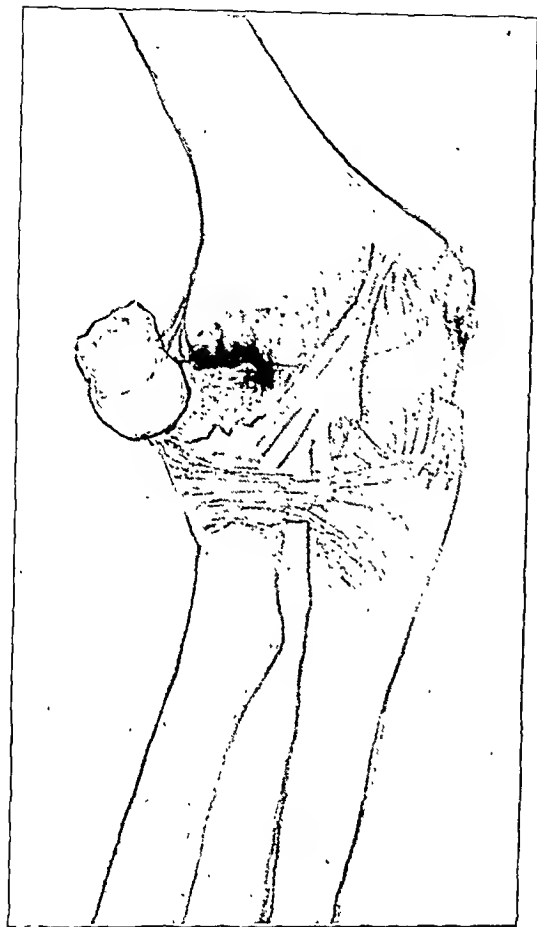


FIG. 3

Capitellar epiphysis fractured and dislocated laterally and upward. The weak unprotected capsule above the annular ligament is the point of rupture. (Compare with Figures 1-A and 1-B.)

and trochlear portions) was revealed by the appearance of the denuded end of the upper humeral fragment, as well as the continuity of the capitellar and trochlear areas within the capsule of the joint (Figs. 5-A and 5-B).

The capitellum and a portion of the lateral third of the trochlear epiphysis may fracture and subluxate in the same way as previously described. In such injuries the capitellum may be found to be displaced laterally and upward, and rotated 180 degrees on its transverse axis. The explanation for this is that the capsule remains attached to the external epicondyle or small bit of diaphysis which is fractured with the capitellum. As the capitellar epiphysis bursts through the capsule

the injury in that the *radius and ulna retain their respective relations with the upper humeral fragment*, and the elbow joint retains its contour except for the post-traumatic swelling. The untorn capsule, especially the strong mid-anterior vertical fibers, reinforced by the broad tendon of insertion of the brachialis, prevents the trochlear epiphysis from coming forward out of the joint with the capitellum. As a consequence, the capitellum with the trochlea slips laterally and rotates on a transverse axis, so that the capitellum rides up and forward and the trochlea is subluxated within the joint capsule (Figs. 4-A and 4-B). In this position, the trochlea locks the joint from either full flexion or full extension and, in conjunction with an intact medial lateral ligament, prevents the bones of the forearm from being pulled back as is usually the case in dislocation of the bones of the forearm. Exactly the same state of affairs was found in the last case of our series, and the complete epiphyseal separation (of the capitellar

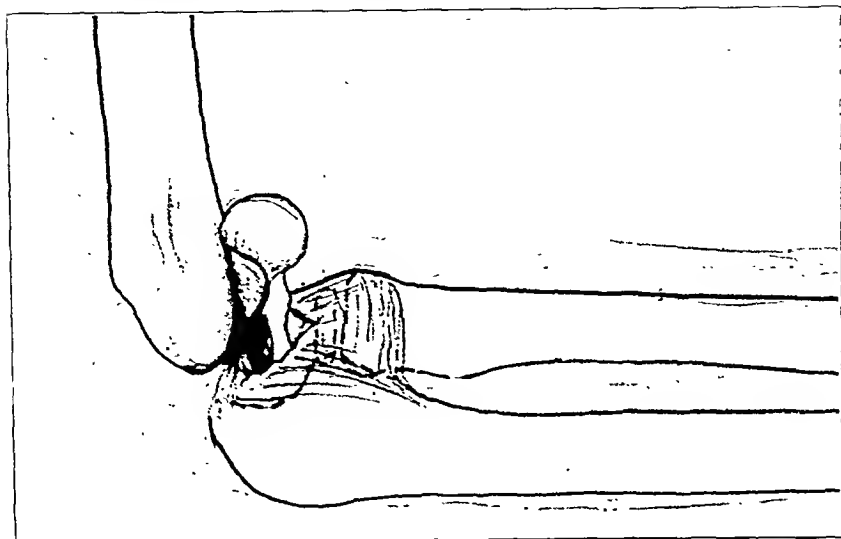


FIG. 4-A

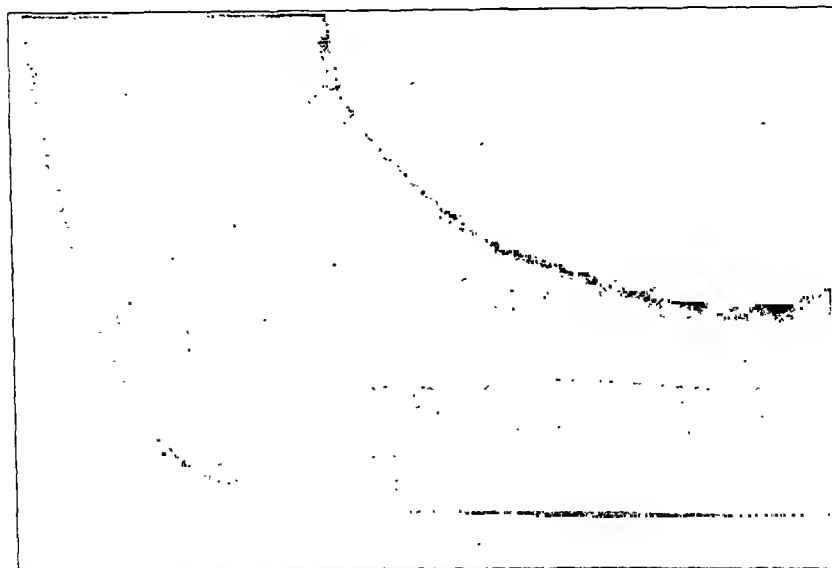


FIG. 4-B

W. M., aged six years. Epiphyseal fracture-dislocation. The capitellar epiphysis has been driven through the lateral anterior capsule; the trochlear epiphysis separates with the capitellum and is prevented from dislocating anteriorly by the mid-anterior capsular fibers and the tendon of the brachialis, so that the trochlea slips laterally and rotates within the joint. The trochlear epiphysis is not visible in roentgenograms taken at this age.

anteriorly, it rotates still further as the unexpended force drives it upward and the posterior lateral surface of the condyle is held by the untorn capsule. Such displacement would scarcely yield to closed manipulation.



Fig. 5-A

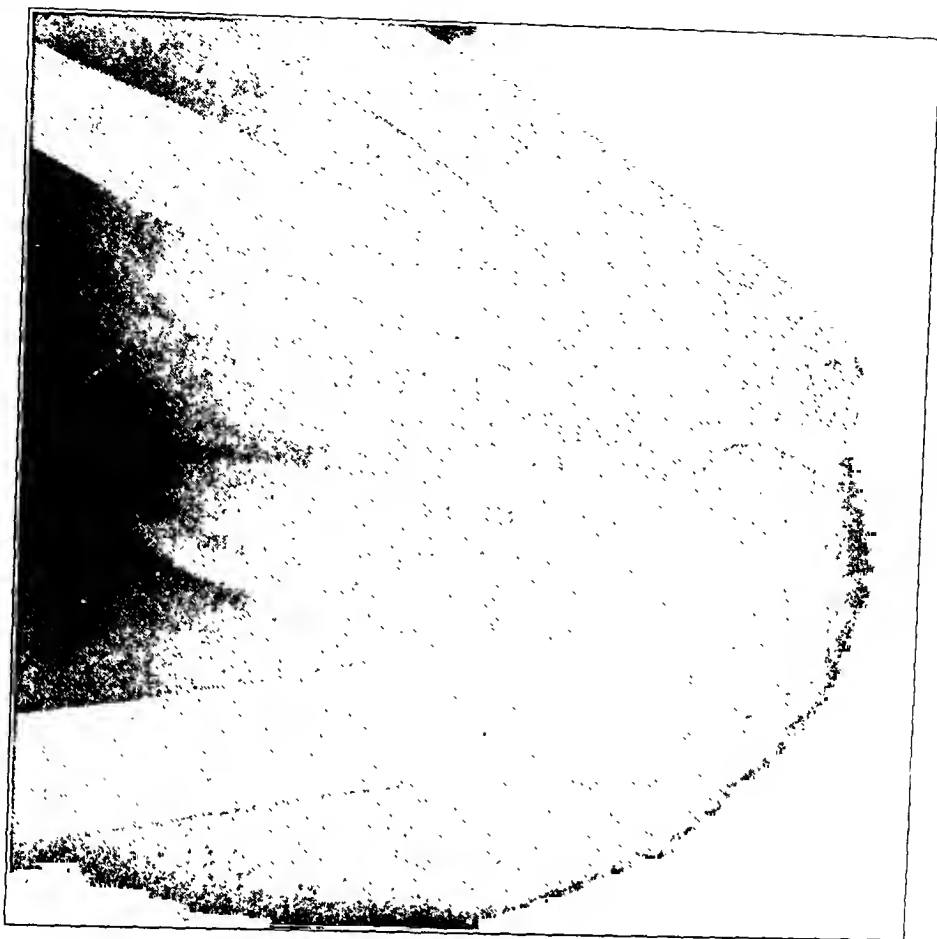


Fig. 5-B

R. B., aged nine years. Complete epiphyseal separation and dislocation of the lower end of the humerus (with the exception of the internal epicondylar epiphysis), disclosed at operation. (Compare with Figure 4-A.)

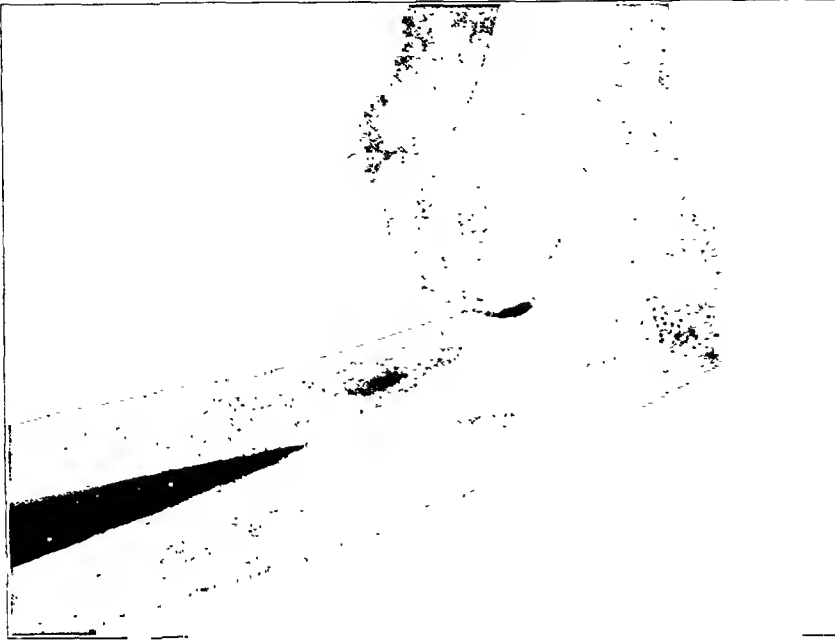


FIG. 6

An old healed diacondylar fracture-dislocation of the condyles of the humerus, with backward dislocation of the forearm. It is conceivable that the dislocation of the forearm may be secondary to the fracture-dislocation of the condyles if reduction is not obtained.

In cases of unrecognized or unreduced epiphyseal separation and dislocation, it is conceivable that the radius and ulna will undergo secondary late posterior dislocation. Such a case is described by Poland. This condition is also shown in the cases of two adults of our series in each of which the forearm was dislocated backward and a healed diacondylar fracture or epiphyseal-separation dislocation was shown by the forward displacement of the lower humeral joint surface in relation to the long axis of the humerus (Fig. 6). That the mechanism of these epiphyseal fracture-dislocations is direct violence, produced by a fall on the flexed elbow, is clearly shown by the case under Dr. Emile Holman's care, included in this series, in which not only was the entire epiphysis partly subluxated laterally and upward, but the olecranon suffered a comminuted compression fracture as well. This is in accord with Kocher's experimental production of intra-articular diacondylar fracture of the elbow by compressive forces acting from below and behind the elbow, and with the experience of Bergenfeldt who found that four of his five patients with fracture-dislocation of the capitellar epiphysis had fallen on the point of the flexed elbow. Wilson is of the opinion that the injury is caused by a varus deviation of the forearm brought about by indirect violence. Certainly in our cases there is a history of direct violence, and at operation the anterior and anterolateral portions of the joint capsule

are found to be free of the epiphysis, with the epiphyseal fragment attached by the posterolateral capsule. The fragment is more often displaced upward than distalward by extensor-muscle pull.

### CONCLUSIONS

1. Lower humeral epiphysiolyis with dislocation of the epiphysis (of the capitellum and trochlea, or of the capitellar portion alone) is a relatively common injury in the first decade of life.

2. This compression injury is sustained by direct violence,—falling on the flexed elbow.

3. As the epiphysis separates and the force continues, the capitellar epiphysis is forced through the anterior capsule and dislocation occurs. The capitellar epiphysis alone may separate, or the capitellum with the trochlear epiphysis may subluxate.

4. Closed reduction may occasionally be successful. Reduction when incomplete is followed by extreme loss of function; therefore, operative reduction is warranted in every case in which reduction by manipulative methods is incomplete.

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# AN X-RAY STUDY OF THE DIAPHRAGM \*

BY LLOYD T. BROWN, M.D., BOSTON, MASSACHUSETTS

## PART I

### ITS CORRELATION TO BODY MECHANICS IN CHILDREN

The following study was undertaken to find out what effect, if any, improvement in the general physical health of children would have on the action and position of the diaphragm, as well as on the size and shape of the pleural cavities. The study was carried out at the Prendergast Preventorium, in Boston, Massachusetts, and was made possible by the Boston Tuberculosis Association. These children, by their environment and associations, had been exposed to pulmonary tuberculosis, but showed no clinical or x-ray evidence of the disease. They were at the Preventorium in order to get the best possible chance of regaining sufficient resistance to combat any further tendency to the disease. While at the Preventorium the routine of the children consisted of careful medical supervision by an internist, an expert in the care of tuberculosis; regular periods of play, study, and rest under the supervision of trained nurses and a physiotherapist. The rest period was always started with the children in the position of hyperextension and a few simple exercises were used to train them in the correct use of the body.

Certain observations and measurements were made at the beginning and end of the study. These consisted of age, weight, vital capacity, grading of the posture, chest measurements at the ninth rib in the position of full inspiration, complete expiration, and in the neutral or habitual breathing position of the chest. Photographs of the body from the antero-posterior and lateral views were also taken. The most important record in each case was an x-ray picture of the heart and diaphragm. This was taken with the child in the standing position leaning against the film, and with the tube at a distance of sixty inches. Two exposures were made on each film,—the first with the chest in the position of expiration, so that the diaphragm would be at its highest level; and the second in inspiration, so that the diaphragm would be at its lowest point. The time of the first exposure was three-twentieths of a second, and that of the second exposure was one-half of the first. The tube was always focused at the same level on the chest.

There were twenty-six children studied,—seventeen boys and nine girls, varying in age from six to twelve years. The average period of observation was three months; the shortest period was twenty-four days and the longest four months and twenty-three days.

\* Read at the Annual Meeting of the American Orthopaedic Association, Rochester, Minnesota, June 8, 1934.

## FINDINGS

*Weight*

There was an average gain in weight of four pounds and two ounces, the greatest gain being twelve pounds and four ounces. There were four children who lost weight, the greatest loss being eight ounces.

*Vital Capacity*

The vital-capacity readings were taken at the beginning and at the end of the study and showed an average gain of 250 cubic centimeters. Four of the children showed no change. The greatest gain was 800 cubic centimeters.

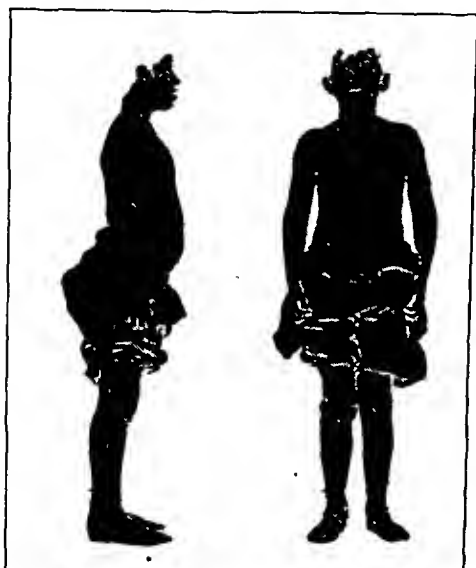


FIG. 1-A

M. F., aged eight years, March 2, 1932.  
 Weight: 51 pounds, 4 ounces.  
 Vital capacity: 800 cubic centimeters.  
 Chest circumferences:  
   Inspiration       $24\frac{1}{2}$  inches  
   Expiration       $21\frac{1}{2}$  inches  
   Habitual         $21\frac{1}{2}$  inches



FIG. 1-B

M. F., aged eight years, June 4, 1932.  
 Weight: 57 pounds, 4 ounces.  
 Vital capacity: 1,300 cubic centimeters.  
 Chest circumferences:  
   Inspiration       $25\frac{1}{2}$  inches  
   Expiration       $23\frac{1}{2}$  inches  
   Habitual         $24\frac{1}{2}$  inches

*Body Mechanics*

From photographs taken at the beginning and at the end of the study it was possible to make a rough grading of the body mechanics in all but four of the children. Every child showed an improvement in his body mechanics as well as a definite knowledge of how to use the body better than at the time of the first observation.

*Chest Measurements*

These measurements were taken at the level of the ninth rib, since this position gives the most information in regard to the change in the shape of that part of the chest at which the diaphragm is attached. The measurements were taken in the position of inspiration, expiration, and in the neutral or habitual position of breathing. It was considered that, if

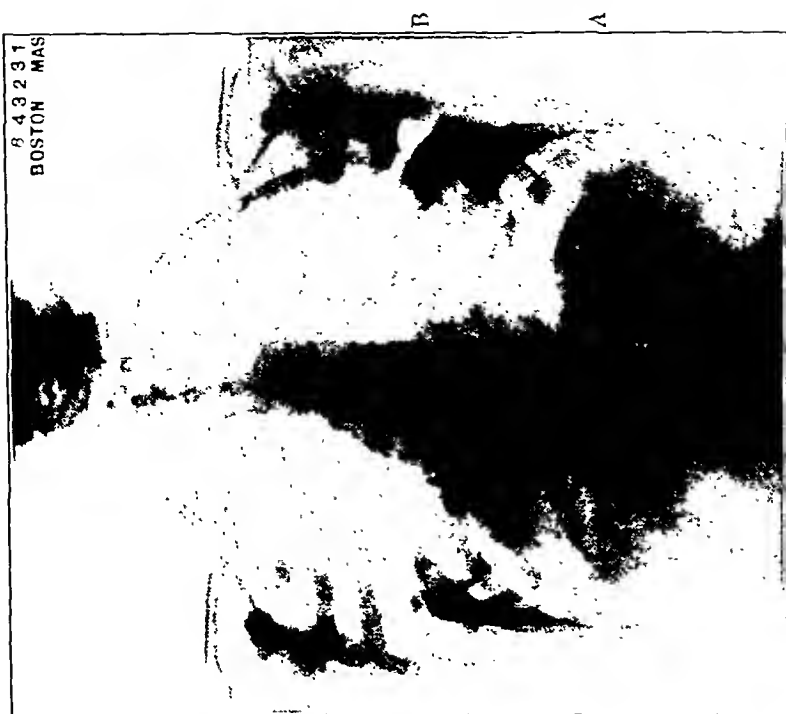


FIG. 2-B

Each roentgenogram shows two exposures,—the diaphragm in  
Fig. 2-B. Taken at the end of the period of observation.

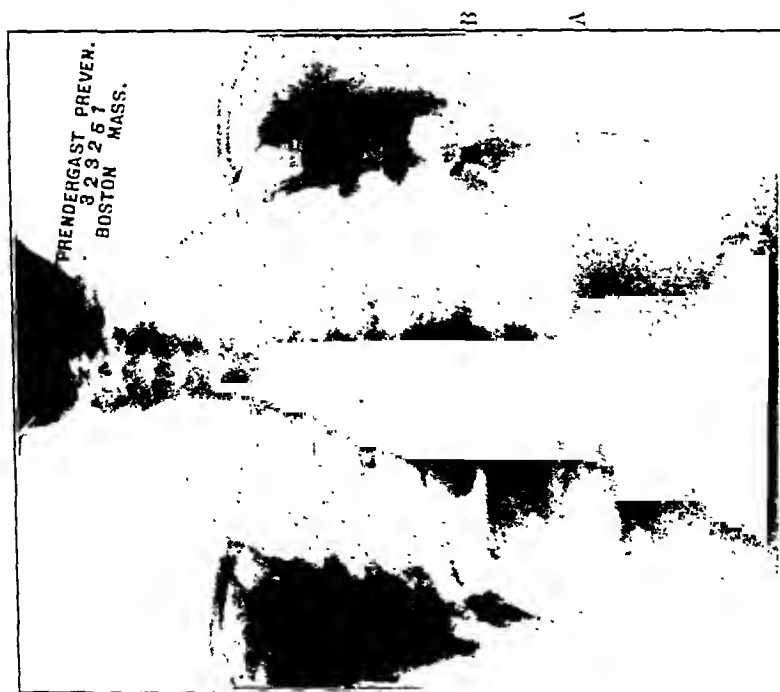


FIG. 2-A

Roentgenograms of the diaphragm taken in the standing position.  
Inspiration (A) and in expiration (B).  
Fig. 2-A. Taken on admission.



any change should come in these measurements at the second observation, a correlation would be of interest between them and possible changes in the amount of the excursion of the diaphragm, the rib level of the diaphragm, and the length of the chest or pleural cavity. The results showed that in 96 per cent. of the patients there was an increase in the size of the chest in inspiration; in 4 per cent. the size of the chest remained the same; in no case did the chest become any smaller. In expiration, 69 per cent. of the patients could not make their chests as small as they were at the first observation; 26 per cent. showed no change in size; and one child could make his chest smaller in expiration, but he could also make it bigger in inspiration and his habitual position showed an increase in the size of the chest. The size of the chest in the neutral or habitual position of breathing increased in 96 per cent. of the children; it remained the same in one child; and in none was it any smaller.

### *Excursion of the Diaphragm*

From this it can be seen that, accompanying the gain in weight, the increase in the vital capacity, and the improvement in the body mechanics, there was also an increase in the size of the chest itself. With these improvements, it would be logical to expect an increase in the amount of the excursion of the diaphragm because, if the ribs are held up and apart, the diaphragm, which is attached to the ribs, must also be held up higher and in a position allowing a freer and greater excursion. The measurements of the excursion of the diaphragm were taken from the roentgenograms at the beginning and at the end of the observation of each child. The measurements were made on the film by taking the distance between the shadows of the diaphragm in inspiration and expiration on both the right and the left sides. It was found that on the right side the excursion increased in amount in 86 per cent. of the patients; it remained the same in 7 per cent.; and it became less in 7 per cent. On the left side, 81 per cent. showed an increased excursion; 7 per cent. showed no change; and in 12 per cent. the excursion became less.

### *Position of the Diaphragm*

Thus far we have found that accompanying the gain in weight, the increase in the vital capacity, the improvement in the body mechanics, and an increase in the size of the chest, there is also an increase in the amount of the excursion of the diaphragm. With these increases it seemed there would probably also be a change in the position of the diaphragm in relation to the ribs. In the roentgenogram it was possible to locate at which rib was the highest point of the diaphragm in both inspiration and expiration on both the right and the left sides. On the right side in inspiration, it was found that in 38 per cent. of the cases the diaphragm was at a higher level at the end of the observation; in 42 per cent. it remained at the same level; and in 20 per cent. it was at a lower level. On the left side in inspiration, the diaphragm was at a higher level

in 34.5 per cent. of the cases, at the same level in 46 per cent., and at a lower level in 15.5 per cent. In expiration on the right side, the diaphragm was at a higher level in 69 per cent., the same level in 31 per cent., and in no case was it at a lower level. On the left side in expiration, in 73 per cent. the diaphragm was at a higher level, in 23 per cent. at the same level, and in 4 per cent. at a lower level. This would seem to indicate that the position of the diaphragm is very definitely influenced by the shape of the chest,—the better the shape and position of the chest, the higher will the diaphragm be found in the chest in both inspiration and expiration, as well as in the neutral position, and the greater will be the excursion.

### *Size of Pleural Cavity*

With these changes it was interesting to see if there would be any difference in the size and shape of the pleural cavity. This was measured by taking the distance from the first rib to the top of the diaphragm in each series of films. It was found that on the right side the length of the chest was lessened in 80 per cent. of the cases, it stayed the same in 20 per cent., and in no case did it become any longer. On the left side there was a greater change,—the chest was shorter in 89 per cent., the same in 11 per cent., and in no case was it any longer.

### COMMENT

A résumé of the findings in this study brings out a few possible generalizations. Of course, in only a few of the children did all the improvements noted occur, but it was surprising that in so many of the children it was possible to make a very close correlation of the gain in weight, the increase in the vital capacity, and the size of the chest, with the improvement in the body mechanics, an increase in the amount of the excursion of the diaphragm, a higher position of the diaphragm in the chest, and a lessening of the length of the pleural cavity.

### CONCLUSIONS

1. The position and the amount of excursion of the diaphragm is affected by the shape of the chest.
2. In the case of a chest which is used in the position of expiration, the common one in faulty body mechanics, not only is the diaphragm in a lower position in the chest, but also there is less excursion.
3. In the case of a chest which is used in the position of good body mechanics, the diaphragm is in a higher position in the chest and there is a greater excursion of the diaphragm.
4. Accompanying these changes, there is also an improvement in the general condition of the patient as a whole,—an increase in weight, an increase in the vital capacity, and an improvement in the body mechanics.

## PART II

## ITS APPLICATION TO THE TREATMENT OF PULMONARY TUBERCULOSIS

The shape of the pleural cavity varies with the shape of the chest and the position of the diaphragm as has been shown in Part I of this study. If the ribs are raised and rounded, as in the position of full inspiration, not only is the pleural cavity (especially in the region of the apex) at its widest and deepest position, but the diaphragm, being at its lowest position, makes the whole pleural cavity as large as possible. Since the lungs are in constant contact with the pleura, the size and shape of the chest must similarly affect the size and shape of the lungs. Therefore, when the pleural cavity is at its largest size, the lungs must be stretched or pulled out to their greatest size. In faulty body mechanics, with the diaphragm in an habitually low position, the lungs must be stretched or pulled downward to their fullest extent. But in faulty body mechanics, in addition to the low position of the diaphragm, the upper part of the chest is no longer rounded and full, giving it depth and width, but it is narrowed both in its depth and width so that the apex is nearly at its smallest size. This means that, while the lower and middle lobes of the lung are stretched or pulled downward, the apex is squeezed by the shape of the ribs and chest to nearly its smallest size. Therefore, whatever motion may take place in ordinary respiration, with little or no chest or rib action, must take place in the middle or lower lobes, and the apex must be practically without motion. This would explain why, as Kraus says, "in adults [tuberculous] infection is more likely to settle in the apex than in the mid-lung or caudal region and why apical lesions offer in general the better prognosis". It is also interesting that in children, tuberculous infection is most common in the region of the hilum while it is rare in this position in adults. To explain the location of infection in tuberculosis, Kraus gives two concepts based on Tendeloo's view of the kinetic energy of the lymph flow. He says: "Limitation of movement [of the lungs] favors localization of infection, yet it promotes arrest of the process; freedom of movement militates against infection but facilitates development and dissemination of a lesion that has become established."

From the point of view of body mechanics, in children, in whom there is little limitation of the motion of the chest wall or ribs, and who have few habitual positions of sitting or standing such as are necessary or common in adults (young or old), there is likely to be little or no more limitation of motion of the apices than of any other part of the lungs, and so infection tends to be pushed along to the hilum where the kinetic energy of the lymphatics is the least. In adults, on the other hand, to whom sedentary or other occupations requiring little activity are common, the habitual faulty mechanics of the chest make apical infection more probable and, according to Kraus's concept, easier to heal than an infection in the middle or lower lobes.

In the treatment of pulmonary tuberculosis, it is interesting to con-

sider what effect good body mechanics may have on the shape and action or motion of the lungs. As has been shown, in faulty body mechanics the lungs are stretched or pulled downward to their greatest extent in the two lower lobes and are compressed to their greatest extent in their apices. Such a shape or position means that any further movement of the diaphragm will increase the stretch or pull, and any movement of the chest wall or ribs, particularly in the region of the apices, will tend to expand the apices. If there are adhesions or fibroses forming in any cavities, such movement would militate against the healing process. In other words, in faulty body mechanics the margin of safety in any of the lobes of the lung is very small. For this reason in recent years, because by the usual methods it has been impossible to provide sufficient rest to the infected lung and cavities, the profession has turned to surgery to accomplish this result. There are three methods used to get as much rest to the infected part as possible, all of which are based on the theory of collapsing the infected lung. These methods are pneumothorax, section of the phrenic nerve, and thoracoplasty. The idea behind each of these procedures is to compress the lung as much as possible, thereby reducing the size of the cavities and thus allowing Nature to heal the process. In each procedure, as this study emphasizes, the condition of the other lung is of the greatest importance since in any of them a much greater strain is put on the good lung. Not only does such a procedure add a greater strain, but, at the same time, it leaves the so called good lung in a position of faulty mechanics which can only mean that the lung as well as the whole body must do more work and, because of the collapsed chest wall, must do it in a position of even worse mechanics.

It is well recognized that in cases of tuberculosis of the lungs it is usual to find a tendency to a moderately high diaphragm in the x-ray. This is evidently Nature's attempt to take some of the strain away from the infected part and to help reduce the size of the cavities. It is equally well recognized that faulty mechanics of the whole body is also very commonly, if not always, found. When it is seen that the position of good mechanics of the whole body not only follows out the line pointed to by Nature in raising the diaphragm in the chest, and by so doing lessens or removes the strain on the lungs or the cavities in them, but that it also makes possible the better functioning of the rest of the body, there is reason for one to think deeply about instituting any form of treatment,—such, for example, as surgical procedures which, though they may benefit the local condition, undoubtedly create other deformities which must put a greater strain on the other lung and the rest of the body.

Therefore, according to the findings of this study, in the cases where surgery is considered necessary, a carefully planned procedure to improve the body mechanics either before or after surgery would seem to be a logical step in the treatment.

In conclusion, this study has shown that, with improvement of the body mechanics in children, there is an increase in the size of the chest and

in the amount of the excursion of the diaphragm; that the diaphragm is higher in the chest; and that the chest or pleural cavity is shorter and wider. This must mean that there is much less strain on the lungs in respiration, since the lungs are neither stretched out lengthwise, as must occur with a low diaphragm, nor compressed at the apex, as is found in the elongated chest so commonly seen in faulty body mechanics.

Therefore, from the point of view of the prophylaxis as well as of the treatment of pulmonary tuberculosis, a proper understanding of the relationship of body mechanics to respiration is essential.

# FURTHER STUDIES CONCERNING THE REPAIR OF ARTICULAR CARTILAGE IN DOG JOINTS \*

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An earlier study concerning the repair of surgical defects made in hyaline cartilage of normal dog joints <sup>1</sup> revealed that reparative processes are at best feeble, that they take place more readily near the perichondrial margins and on the weight-bearing articular surfaces. It was further learned that such repair may take place in one of three ways:

1. By independent proliferation of original cartilage cells.
2. By proliferation of vascular connective tissue from the perichondrial margins.
3. By ingrowth of vascular connective tissue from the subchondral bone-marrow spaces when such are included in the defects.

The present study was undertaken in order to compare the reparative processes of similar defects, made in young dogs before epiphyseal union had occurred, with those already recorded in adult dogs.

## MATERIALS AND METHODS

The knee joints of seven puppies, three to four months old, were used for these experiments. The operations were performed under ether anaesthesia. In each instance a defect, approximately eight by two by five-tenths millimeters, was made near the center of the patellar surface of the femur. The surgical procedure employed was similar to that described in the previous experiments except that no defects were made on the condylar surfaces. This was avoided since the stretching of joint structures necessary to expose the weight-bearing surfaces of the femur had previously led to frequent displacement of the patella. The puppies were sacrificed under ether anaesthesia at such time intervals that lesions of four, twelve, twenty, and twenty-eight weeks' duration were available for study. The technical methods were identical to those employed in the previous study <sup>1</sup>. The diet consisted of bread, milk, meat, liberal amounts of orange juice, and cod liver oil.

## MACROSCOPIC EXAMINATION OF THE JOINTS

Seven of the ten joints appeared normal save for the surgically created defects in the cartilage of the patellar surface of the femur. The three joints not included in this final study were discarded because of

\* This is publication Number 15 of the Robert W. Lovett Memorial for the Study of Crippling Disease, Harvard Medical School, Boston, Massachusetts.



FIG. 1

A gross photograph of the left knee joint of a three-months-old puppy, showing the type of surgical defect made on the patellar surface of the femur. No healing is apparent after twelve weeks.



FIG. 2

The macroscopic appearance of this twelve-weeks-old defect indicates slight repair in the lower half of the lesion. The upper end of the defect shows no evidence of reparative change.

abnormalities resulting from faulty technique. In one instance, the defect had extended into subchondral bone; in the other two joints, the synovial membrane was discolored and an increased quantity of synovial fluid, containing flecks of fibrin, was present. These later changes were thought to be secondary to hemorrhage occurring at the time of operation. In one of these two joints, the patella was slightly displaced toward the medial condyle.

The surgical defects of four and twelve weeks' duration showed no visible evidence of reparative changes. The margins appeared as sharp and clear-cut as they did at the time of the operation (Figs. 1 and 2).

The lesions of twenty and twenty-eight weeks' duration, while still plainly visible, were bounded by indistinct rounded margins and appeared slightly less deep than when first made. In such lesions, in the deepest portions of the defects, small areas were observed that were more opaque than the normal cartilage surrounding them (Fig. 3). None of the lesions showed macroscopic evidence of having completely healed.

#### MICROSCOPIC EXAMINATION OF THE JOINTS

Histological sections were made from similar areas in each joint. These included representative levels of the surgical defects, cross sections of the entire articular surface of the femur, sections of the synovial membrane, and longitudinal mid-line sections of the fragments of cartilage removed at the time of operation. The latter sections were made in order to detect and exclude any joints in which the defects had extended into subchondral bone. All sections were stained with hematoxylin and eosin.

Histological examination of the one satisfactory joint containing a defect of but four weeks' duration did not reveal any important changes in the synovial membrane or joint capsule. There was one small fibrous scar in the synovial membrane and subsynovial tissue. This contained hemosiderin pigment and was interpreted as evidence of a small hemorrhage in the operative incision. The defect showed definite evidence of early reparative changes. In one portion, the base of the defect was filled with avascular and cellular fibrous tissue. In the deeper layers this new tissue consisted of cells having the morphology of regenerating cartilage cells between which a considerable amount of new cartilage matrix had been deposited. In a few places, this newly formed tissue was in such intimate contact with the cells in the original cartilage as to leave little doubt that it had originated by independent proliferation of original



FIG. 3

A gross photograph of the right knee joint of the same puppy illustrated in Fig. 1, showing a surgical defect in the patellar groove after twenty-eight weeks. The defect is not as deep or as distinct as when first made.



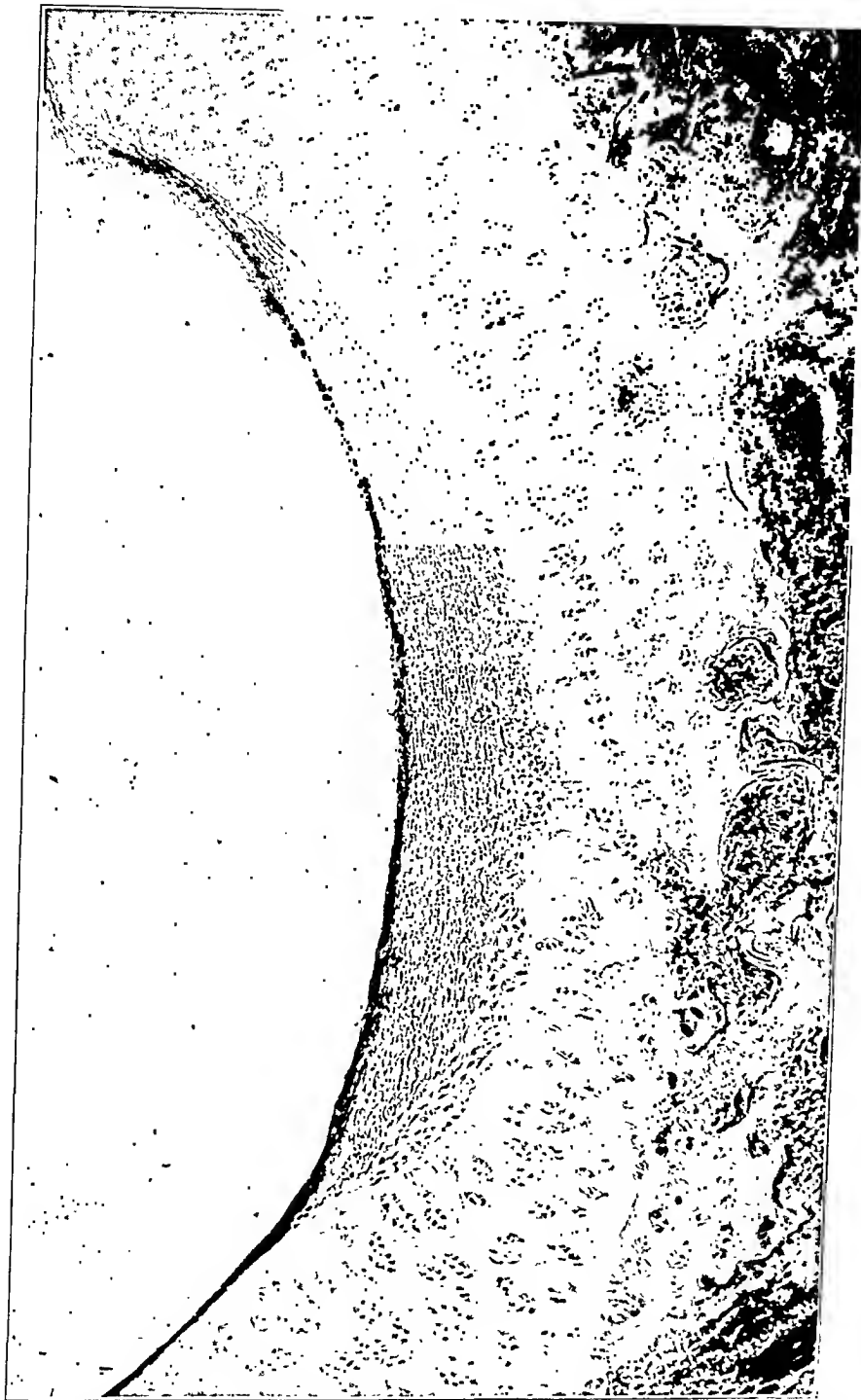


Fig. 4

Photomicrograph ( $\times 100$ ) showing one end of the surgical defect made four weeks previously. Note the avascular proliferation of fibroblastic-appearing cells over the base of the defect and the differentiation of this fibrous tissue into cartilage near the left-hand margin of the defect. The other end of this defect is illustrated in Fig. 5.

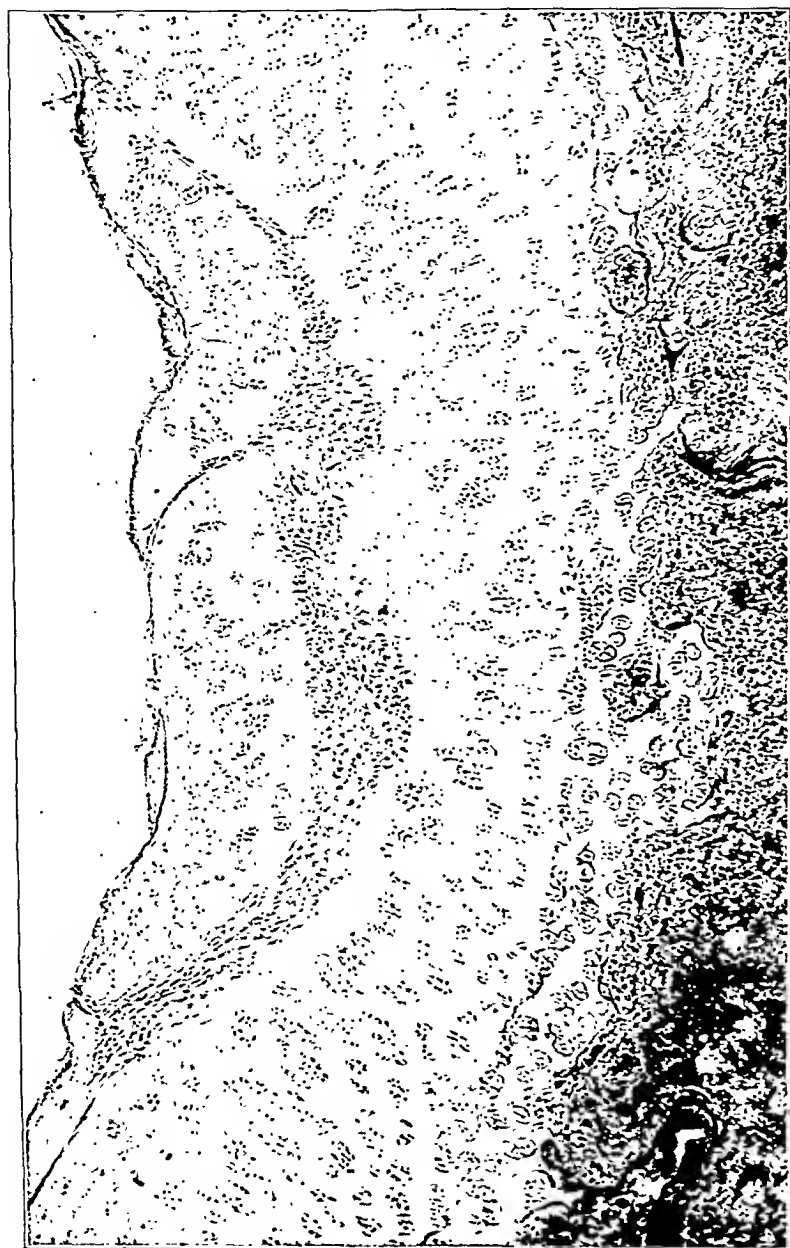


FIG. 5

A photomicrograph ( $\times 100$ ) showing active proliferation of cartilage cells in a protected crevice beneath partially detached fragments of articular cartilage. This lesion was four weeks old.

cartilage cells (Fig. 4). Repair was more extensive in this four-weeks-old defect than in any other defect studied with the exception of one of twenty-eight weeks' duration. A possible explanation of this fact was found when sections from other portions of the lesion were examined. These revealed that, in making the defect, a small shaving of cartilage had been partially detached, but not completely removed. In consequence, there existed at one end of the defect a crevice in the articular cartilage. The existence of such a crevice would seem to afford an ideal environment for the repair of articular cartilage because in the two joints where crevices were detected the most extensive repair had taken place. This is well shown in Figure 5 where one notes a marked proliferation of cartilage cells and the formation of considerable cartilage matrix. It seems reasonable to believe that this unusual degree of regeneration in the crevice had been largely responsible for the extent of repair observed in the uncovered portion of the defect.

The lesions of twelve weeks' duration showed little evidence of any reparative change. In each instance, the columns of cartilage cells converged slightly toward the margins of the defects, indicating that the defects had become slightly reduced in width. Although the free margin of each defect was formed by uncovered cartilage matrix, the cartilage cells within some of the adjacent lacunae had begun to multiply. Histological examination of the synovial membrane from these joints showed no abnormality.

Microscopic examination of sections from the joints containing lesions of twenty weeks' duration revealed no variations from the normal in the synovial membrane. The articular cartilage and subchondral bone were likewise normal. The surgical defects appeared as shallow depressions, no one of them extending deeper than the upper third of the articular cartilage. Although the columns of cartilage cells tended to converge toward the base of these defects, evidence of proliferation of original cartilage cells was limited to a few small nests of cells in which it was evident that multiplication had taken place within lacunar spaces (Fig. 6). In light of the previous studies <sup>1</sup> it would seem reasonable to conclude that such proliferation of cells might eventually result in the formation of fibrocartilage (Fig. 7).

In contrast to the defects already described, marked reparative changes were seen in one lesion which had existed twenty-eight weeks (Fig. 8). Examination of a series of sections representing the whole of this lesion revealed that a partially detached thin shaving of cartilage had been left at one end of this defect. Such pronounced proliferative changes had occurred beneath this thin strip of cartilage that this portion of the defect was almost completely filled with recently formed cartilage. This newly formed cartilage was obviously the result of multiplication of the original cartilage cells adjacent to the defect. In the portion of the defect which had been completely excavated, there was but little evidence of cellular proliferation from the underlying cartilage cells.



FIG. 7

This photomicrograph ( $\times 111$ ), made from a section of a defect of twenty weeks' duration in the joint of an adult dog, further illustrates a greater proliferative activity from the deeper cartilage cells as compared to those nearer the articular surface. Note that this proliferation has resulted in the formation of a layer of fibrocartilage of considerable thickness.



FIG. 6

Photomicrograph ( $\times 111$ ) of one margin of a twenty-week-old surgical defect, showing clusters of regenerating cartilage cells. Note that the greatest proliferative activity is near the basal layer of cartilage.

FIG. 8

Photomicrograph ( $\times 115$ ) showing presence of well formed cartilage in a defect of twenty-eight weeks' duration. A series of sections from this specimen indicated that the greatest proliferation of cartilage cells had taken place in protected areas like those shown in Fig. 5.



## DISCUSSION

It is of considerable clinical importance to know whether articular cartilage in the young growing individual is more capable of reparative changes than adult articular cartilage. Because of the differences in vascular supply, maturity of cartilage cells, and cartilage matrix<sup>2</sup>, one might suspect that the repair of articular cartilage in the young would be more rapid and complete. In order to verify or disprove this suspicion, the foregoing experiments were undertaken. Only patellar-groove defects were studied because of our previous observations.

The previous studies<sup>1</sup> had revealed that surgical defects near the perichondrial margins of the femoral condyles showed more evidence of repair than did similar defects made in the central portion of the patellar surface of the femur. In two such patellar-groove defects, no reparative changes were noted at the end of four and twelve weeks, respectively, and only slight proliferative changes were noted in the defects of twenty and twenty-eight weeks' duration.

Therefore, in the present series of experiments, patellar-groove defects were selected for study, since it was believed that healing, occurring with regularity in this location after comparable periods of time, would be indicative of a greater proliferative ability on the part of the cartilage cells in the younger animals. However, because no important proliferation of cartilage cells occurred in the majority of lesions in this series of experiments after four, twelve, twenty, and twenty-eight weeks, one is led to believe that there is no important difference in the reparative capabilities of articular cartilage in similar articular areas of young and adult animals of the same species.

The most satisfactory repair was observed (Figs. 5 and 8) in the two defects in which "protected" crevices existed. This finding suggests that friction of the moving patella over the exposed defect may inhibit repair by regeneration of original cartilage cells. The observations made in these two studies would seem to indicate that repair by proliferation of the original cartilage cells is in part dependent upon the depth of the defect,—the deeper the defect, the more likely is this type of repair to take place. The same studies further indicate that the most satisfactory repair takes place when the surgical defect extends into subchondral bone. In such instances granulation tissue from the marrow spaces gradually fills the defect. The granulation tissue passes through the stages of fibrous tissue and fibrocartilage to the formation of an imperfect form of hyaline cartilage. In such defects a calcified zone of cartilage may reform.

The findings in these studies, as well as the previous ones, indicate that such articular-cartilage defects are not the cause of important associated intra-articular pathology as Key has reported<sup>3</sup>. Our observations lead us to conclude that associated intra-articular pathology is found only in joints where the patellae have become displaced.

## SUMMARY

1. Reparative changes in surgical defects of the central non-weight-bearing articular cartilage of the knee joints of puppies have been studied and compared with the reparative changes in similar lesions in the adult dog.

2. These comparative studies indicate that the repair of surgically created articular-cartilage defects in similar areas of the joint is no more rapid or complete in young puppies before closure of the epiphysis than it is in adult dogs.

3. The proliferative activity of cartilage cells is greater in the deeper zones of articular cartilage than it is in the more superficial zones.

4. More active proliferation of cartilage cells was noted in lesions in which crevices existed. This finding indicates that the friction generated by the movement of the patella over the defect may be inhibitory to repair by independent proliferation of cartilage cells.

5. The presence of patellar-groove defects is not a cause of important intra-articular pathology.

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## CHRONIC PROLIFERATIVE ARTHRITIS IN PATIENTS WITH RHEUMATIC FEVER\*

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In discussing the various types of arthritis, it is often considered that the joint lesions of acute rheumatic fever and those of chronic proliferative arthritis are essentially separate and distinct clinical and pathological entities which have no bearing one toward the other. If one considers simply the extremes of both conditions—for example, the child who experiences his first attack of acute rheumatic polyarthritis and the adult who presents the classical picture of chronic progressive proliferative arthritis with deformities—such a supposition is justified in so far as the two diseases both clinically and pathologically show little or nothing in common.

This relationship between acute rheumatic polyarthritis and chronic proliferative arthritis has long been a subject of controversy. Since the time of Heberden in 1782 and Haygarth in 1805, who first differentiated acute rheumatism from chronic rheumatism, clinicians have been divided in their opinions into two schools,—those who maintain that the two conditions are entirely separate and those who consider them as different manifestations of the same fundamental process. Among the proponents of the former concept may be mentioned Adams, 1857; A. B. Garrod, 1859; Bristow, 1884; Fagge, 1886; Osler, 1892; and Sir A. E. Garrod, 1908. Supporters of the contrary theory were Jonathan Hutchinson, 1881; Charcot, 1881; Sir Dyce Ducksworth, 1884; Hawthorne, 1900; and, more recently, Kahlmeter in Sweden and Coates in England. There seems to be no justifiable reason clinically or pathologically why one must adopt so extreme a view-point. Both conditions may occur alone and absolutely independently of the other; yet, in certain cases, there appears to be a definite sequential relationship and it is the purpose of this paper to point out the evidence upon which such a statement may be based.

Much of the difficulty responsible for the disagreement in the relationship of acute rheumatic polyarthritis and chronic proliferative arthritis lies in the very loose and inaccurate usage of the latter term. When used correctly it should imply a truly chronic and progressive inflammatory lesion; yet, in the commonly accepted usage, it includes not only the progressive lesions, but also those that have long since healed. That is to say, at the present time when one uses the term chronic proliferative arthritis or its synonyms—atrophic arthritis, chronic in-

\* Submitted for publication January 9, 1934.



fectious arthritis, chronic adhesive arthritis, and rheumatoid arthritis—one includes both healed and chronic progressive lesions. A second cause for disagreement is that many consider chronic proliferative arthritis as a specific disease, just as one considers syphilis or tuberculosis. Such a concept, however, has not been definitely proved. Consequently, our problem is not that of attempting to prove the origin of all cases of chronic proliferative arthritis from acute rheumatic polyarthritis, but, rather, of answering the question as to whether or not certain cases of rheumatic arthritis may develop the same joint lesions as usually seen in non-rheumatic, infectious arthritis. In this paper both clinical and microscopic studies are presented to show the relationship of rheumatic fever to so called "non-specific infectious" or "atrophic" arthritis.

About thirty cases have been collected, ten of which are summarized in Table I. Two typical cases are reported here.

#### REPORT OF CLINICAL CASES

**CASE 1.** B. M., white female, thirty-seven years of age, a widow, complained of dyspnoea, palpitation, and gastric discomfort.

*Clinical History:* At the age of fifteen, the patient had had acute rheumatic fever, with cardiac impairment and acute swelling of the joints of the hands, knees, and feet. After the rheumatic fever had subsided, the joints gradually became painless, but they were subject to recurrent attacks of pain in bad weather. Two years later, the joints of her hands and feet showed considerable deformity and became painful and stiff, but showed neither redness nor swelling. Her tonsils and teeth were removed, but the deformity persisted, and, at the age of eighteen, her hands and feet presented the same appearance as at the present time. This suggests that three years after the initial onset, the lesion had definitely healed. There is no history of recurrent attacks of rheumatic fever or acute arthritis since the initial onset. One year ago the patient was admitted to the hospital with auricular fibrillation, mitral stenosis and regurgitation, and a questionable aortic stenosis. The rhythm became regular with rest and digitalis, and she was permitted to go home. At the present time she has returned to the hospital complaining of severe dyspnoea and orthopnoea.

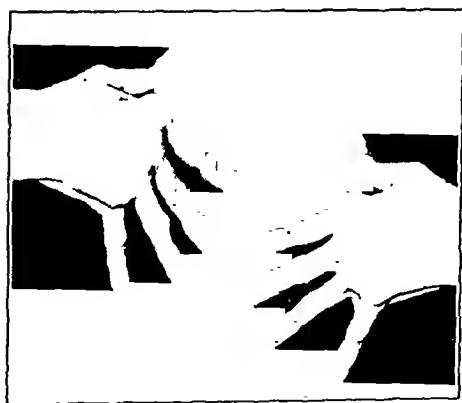


FIG. 1

Case 1, showing ulnar deviation and deformity.

*Physical Examination: Cardiovascular:* The pulse was quite irregular, with a rate of 110, and of poor quality. There was no palpable arteriosclerosis. The point of maximum cardiac impulse was palpable in the fifth interspace ten centimeters from the mid-sternal line. The left border of dulness was seven centimeters from the mid-sternal line and the right border five centimeters. The mid-clavicular line was at seven and five-tenths centimeters. There were no palpable thrills and no Broadbent's sign. There was a harsh systolic murmur, heard best at the apex where

it completely masked the first sound. A low-pitched, mid-diastolic murmur was also audible at the apex. The pulmonic second sound was accentuated. *Joints:* The joints of the hands and feet showed typical atrophic arthritic deformity. *Hands:* The metacarpophalangeal joints were flexed at an angle of 45 degrees. The hands could be closed, but extension was impossible. There were present ulnar deviation, atrophy of the

muscles, and spindling. The roentgenogram showed typical osteoporosis and spindling. *Feet:* The deformity of the toes was marked. The second and third toes of each foot had been removed because of the severe deformity. All of the toes present were flexed and all showed deviation. Spindling and muscular atrophy were pronounced. The severe osteoporosis, deformity, and spindling were shown in the roentgenogram.

*Diagnosis:* Rheumatic heart disease,—mitral stenosis and insufficiency, hypertrophy and dilatation, auricular fibrillation and congestive failure. Chronic healed atrophic arthritis of the hands and feet.

**CASE 2.** A white male, fourteen years of age, complained of pain and swelling in the joints of the hands, knees, and feet and pain in the left chest.

*Clinical History:* The patient first entered the hospital at the age of eight, with a history of pain of two days' duration in the wrists, elbows, and right ankle, and frequent sore throats over a period of several years. On admission, the temperature was 99 degrees, the pulse was 100, and the respiration 25. The patient had a painful left wrist and a multiform eruption on his chest, abdomen, and extremities. The tonsils were large, ragged, and red. The heart on examination showed the point of maximum impulse in the fourth intercostal space, nine centimeters from the mid-sternal line, and a short blowing, systolic murmur at the apex. He was treated with salicylates and rest in bed, and a tonsillectomy was performed one month later. He was discharged from the hospital with the diagnosis of erythema multiforme, arthralgia, and rheumatic fever (?).

Three months before the present admission he had a sore throat, the first since his previous admission. This was associated with some discomfort under the manubrium. One week later the left knee became hot, red, and swollen. This persisted for a week and then shifted to the right knee. This condition alternated for about one month when the left ankle became involved. An inflammatory swelling of the great toe of the right foot followed, and three weeks before admission the fingers of both hands showed a similar change. There is no history of chorea or scarlet fever and no suggestion of cardiorespiratory involvement; and, except during the attack of rheumatic fever six years ago, the patient has engaged freely in athletics without difficulty.

*Physical Examination: Cardiovascular:* The pulse was of the Corrigan type, with a rate of 90. There was no apparent arteriosclerosis. The point of maximum cardiac impulse was seven and five-tenths centimeters from the mid-sternal line, corresponding with the left border of cardiac dullness. The mid-clavicular line was at seven centimeters. The width of cardiac dullness in the second interspace was five centimeters. There was no palpable thrill or Broadbent's sign. At the apex there was a harsh systolic murmur, completely masking the first sound, together with a low-pitched, mid-diastolic murmur. There was also heard along the left sternal border an early, blowing, high-pitched diastolic murmur. *Joints:* The inflammatory activity in the knees and feet had partially subsided when the patient entered the hospital. The hands presented the most noticeable changes, especially in the interphalangeal joints which were swollen and tender. The muscles of the fingers showed some atrophy, and osteoporosis and spindling were evident in the roentgenogram.

*Diagnosis:* Rheumatic heart disease,—mitral stenosis and insufficiency, aortic insufficiency. Atrophic arthritis of the hands.



FIG. 2

Case 2, showing typical swelling and spindling.

Cause of Rheumatic No.	Age at Onset of Fever (Years)	Duration of First Attack	Number of Recurrences	Age on Admission (Years)	Clinical Condition of Joints on Admission	Duration of Present Arthritis	Clinical Condition of Heart
1	15	6 months	None	37	Chronic atrophic arthritis with deformity of fingers, hands, and toes.	22 years	Mitral stenosis and insufficiency; cardiac hypertrophy; auricular fibrillation; and congestive failure.
2	8	6 weeks	One	14	Acute swollen joints. Spindling, atrophy, and osteoporosis developed during second attack.	First attack, 6 weeks; second attack, 10 weeks +	Mitral stenosis and insufficiency; aortic insufficiency.
3	38	6 weeks	None	42	Atrophy and deformity of joints of fingers, hands, and toes. Absorption of joint cartilage of knees.	4 years	Mitral stenosis and insufficiency; cardiac hypertrophy.
4	26	2 months	Five	47	Red, hot, swollen, and deformed.	21 years	Mitral stenosis and insufficiency; auricular fibrillation; cardiac enlargement.
5	45	3 months	One	45	Right knee and ankle swollen and thickened. Loss of joint space.	6 months	Mitral stenosis; cardiac enlargement.
6	41	4 months	One	42	Red, hot, swollen, deformed joints of hands and fingers. Swelling and limitation of motion of knees and elbows.	7 months	Tachycardia; myocarditis; cardiac enlargement.
7	13	2 months +	One, 28 years later	43	Stiffness, limited motion, and absorption of articular cartilage of knees, wrists, and acromioclavicular joints.	2 years (?)	Mitral stenosis; cardiac enlargement.
8	10	5 to 7 months	One, 18 months later	14	Redness and swelling of joints of hands, feet, and knees. Pain and restriction of motion of all other joints.	1½ years	Mitral stenosis and insufficiency; aortic insufficiency; cardiac enlargement.
9	8	3 months	None	10	Swelling, spindling, and atrophy of joints.	2 years	Mitral stenosis; cardiac enlargement.
10	22	6 months	None	26	Atrophy, spindling, deformity, and osteoporosis of joints of wrists, hands, and fingers.	4 years	Mitral stenosis and insufficiency; cardiac enlargement.

An examination of Table I shows that in each case the onset began as acute rheumatic polyarthritis and subsequently, as the disease became chronic, atrophic changes developed in the joints.

The age at onset of the first attack varied from eight years to forty-five years. The duration of the arthritis varied from six months to twenty-two years. Of the ten patients whose cases are summarized, nine had mitral stenosis on admission; the remaining patient (Case 6) was treated shortly after the onset of the disease and recovered without suffering valvular damage.

Aside from the cardiac findings, there were no clinical signs or symptoms to distinguish these patients from those with acute or chronic (non-rheumatic) infectious or rheumatoid arthritis. It is also significant to note that the roentgenographic and laboratory findings were of no value in differential diagnosis.

#### PATHOLOGICAL REPORT

Whereas the clinician's diagnosis of rheumatic fever and of chronic proliferative arthritis is dependent upon a careful history, a thorough physical examination of the patient, and lastly a good roentgenogram, the pathologist must often rely entirely upon a gross and histological examination of subcutaneous nodules or scraps of tissue excised from joints. Consequently, the approach to this problem by the pathologist has been somewhat limited; and, if he is to be able to say anything more in his diagnosis than simply acute, chronic, or healed inflammation, he must find some relatively specific lesion. This was recognized years ago and a search was then made to find some structure which could be considered characteristic of rheumatic infection. Meynet, as early as 1874, pointed out the subcutaneous nodule as a specific lesion of rheumatic origin. Hirschsprung, in 1881, made a histological study of the nodule and described it as a proliferative inflammatory reaction similar to changes occurring in the valves of the heart. We have mentioned the histological changes in the endocardium because, in the past, the study of the pathology of rheumatic fever has been centered about this organ, and it is only in recent years that rheumatic fever has been looked upon as a general disease with histological manifestations throughout the body.

Königer, also seeking a specific lesion, described the histology of a special form of verrucous endocarditis which he considered to be specific for rheumatic fever. One of his most interesting observations was the change in the subendothelial fibroblasts. These cells multiplied, altered their form, extended processes toward the surface, assumed a strange palisade formation, and, in addition, showed slight tinctorial changes. This endocardial lesion has been recently and more fully described by Leary. Very recently MacCallum and Holst have described somewhat similar lesions in the deeper layers of the endocardium, which they also regard as characteristic.

Aschoff, in 1904, and Geipel, one year later, found microscopic

foci of cells (now known as Aschoff's nodules) along the small vessels throughout the myocardium. Fraenkel gave a most accurate description of their nature and the frequency with which these nodules appear in cases of rheumatic fever. Tilp and, later, Jacki compared the histological structure of the large subcutaneous nodules, removed from the galea aponeurotica in cases of rheumatic fever, with the Aschoff's nodule of the myocardium and concluded that the lesions were alike both in morphology and in genesis. Fahr, Coombs, Talalajew, Gräff, Swift, Klinge, and others have more recently made the observation that microscopic lesions simulating the Aschoff's nodules of the myocardium are to be found in the synovia and in the periarticular connective tissue in many cases of rheumatic fever. Fahr also pointed out that these lesions could be found in the absence of large palpable rheumatic nodules, that they were specific for rheumatic fever, and, what is most interesting, that they were found in and about joints showing absolutely no clinical signs and symptoms of inflammation. He also studied the synovial changes and correlated them with the microscopic nodules found in the deeper tissues. He noted that in both cases it was a proliferative change affecting similar cells and he regarded the reactions as analogous and specific. Gräff and Talalajew have extended Folin's observations in respect to the nodules and have successfully demonstrated similar lesions not alone in the heart and about the joints, but also in the tongue, the skeletal and diaphragmatic muscles, the galea aponeurotica, the tendons, the ligaments, the capsule of the tonsil, and in other sites.

Both large and small blood vessels have also been carefully studied in rheumatic fever. Aschoff, Klotz, Fahr, VonGlahn and Pappenheimer have described changes involving all three layers of the vessel.

Briefly summarizing the results of this investigative work in rheumatic fever, we see that different workers at different times have observed various tissue reactions—namely, the large subcutaneous nodules, the microscopic nodules of the myocardium and loose tissues about the joints, the proliferative changes of the endocardium of the synovia, and, lastly, the lesions of blood vessels—which they have regarded as characteristic if not specific for rheumatic infection.

Fahr maintains that Aschoff's nodule is a specific product characteristic of the disease and that its presence alone enables one to establish a diagnosis of "rheumatic granulomatosis". Swift and Klinge, adherents to the allergic origin of rheumatic fever, admit this specificity, but regard the Aschoff's nodule merely as an arch type of a general tissue reaction which differs as much histologically as the disease does clinically. They look upon this proliferative lesion merely as a moderately advanced manifestation—a so called subacute or chronic granulomatous stage—secondary either to necrosis or dissociation of the collagenic ground substance.

Hawthorne has pointed out that, if this specific lesion can be demonstrated in certain cases of chronic proliferative arthritis, provided

we are not dealing with two separate diseases attacking the same individual, then the two conditions merely represent different manifestations of a similar fundamental process.

At this point it will be of interest to mention the observations of Coates and Coombs, Dawson and Boots, and Coates who have demonstrated typical nodules in as many as 20 per cent. of their cases of chronic infectious arthritis.

#### MATERIAL FOR STUDY

The tissue which we have used in the gross and microscopic study of this problem consisted, first, of subcutaneous nodules and synovial and pericapsular tissues removed from patients during varying stages of rheumatic fever; and, second, of synovial and capsular tissue removed from patients clinically diagnosed as having chronic proliferative arthritis, who however showed no nodules, presented no cardiac lesions, and gave no history suggestive of rheumatic fever.

The pathological anatomy of joint lesions of rheumatic polyarthritis during the acute, healing, and healed stages has been too frequently reported (Fahr, Klinge) to warrant another detailed description. It is only pertinent to point out that microscopically one finds synovial cells forming a thickened somewhat palisadelike wall. Here and there are minute foci of necrosis, bordered by degenerating cells. The villi are enlarged; the connective tissue is oedematous and infiltrated with few polymorphonuclear leukocytes and lymphocytes. Deeper in the surrounding connective tissue one may find granulomatous nodules of large, swollen, and often multinucleated cells resembling the Aschoff's nodules of the myocardium, endocardium, and pericardium.

At a later period, one may find a much greater proliferation of the fixed connective-tissue cells of the synovial membrane, organization of fibrin, and an increase in size and number of villi and small foci of lymphocytes about the vessels.

These specific nodules are not permanent structures, regardless of the tissue in which they occur, so that in cases in which healing has taken place one finds simply small non-specific scars.

The pathological lesions of the joints in patients in whom the acute lesion has not subsided, but has progressed in a prolonged chronic course, vary materially from the acute, healing, and healed lesions which have just been described. Histologically there are all the signs of a chronic inflammatory reaction showing exudative, proliferative, and regressive changes, but there is nothing to prove a rheumatic origin. Schmidt and Kaufmann have pointed out that cases of rheumatic polyarthritis that become chronic develop all the gross and histological changes characteristic of chronic proliferative arthritis. In considering the etiology of this progressive reaction, it is possible that we are no longer dealing with the same rheumatic infection which initiated the process, but with various non-specific allergic factors.

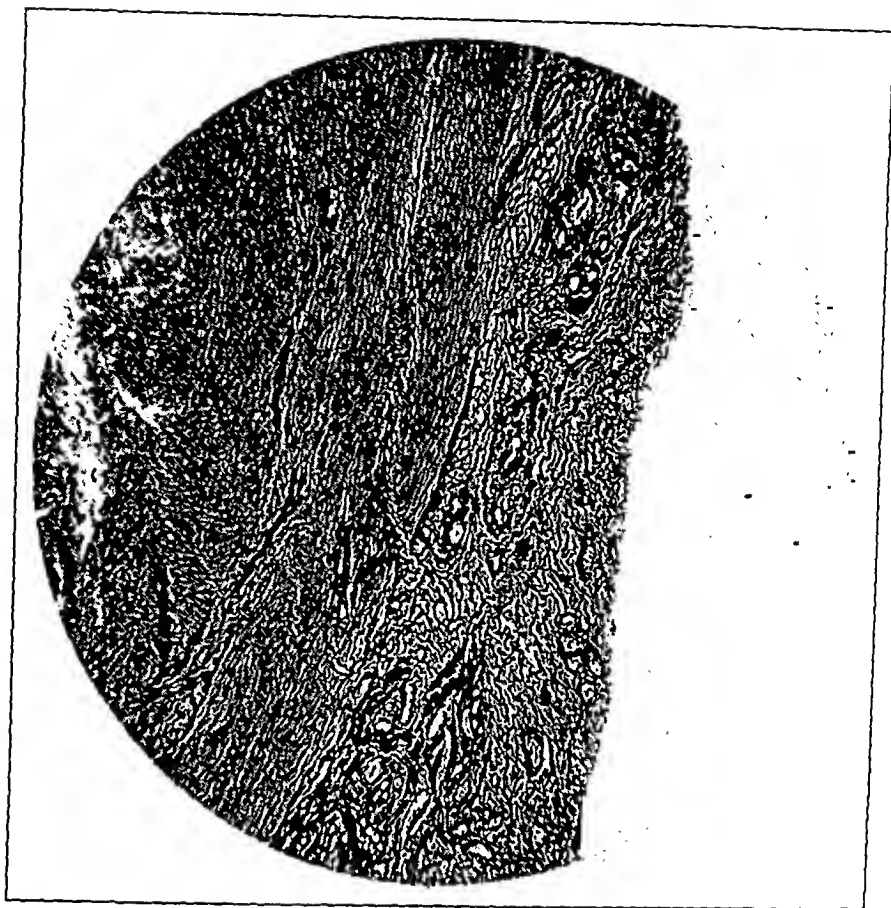


FIG. 3

Low-power photomicrograph of the synovial and capsular wall of the knee joint, following traumatic injury. The synovial cells are small and form a single or, at best, a double layer of relatively undifferentiated cells. Beneath is a rather loose, moderately vascular layer of connective tissue; the vessels here are small, collapsed, and show no pathological changes.

Much has been said about the gross and microscopic changes in chronic proliferative arthritis. Painter, Nichols and Richardson, Pommer, Kaufmann, Schmidt, and others have described the cartilaginous, osseous, muscular and connective-tissue changes in this disease. These consist primarily of a chronic inflammatory reaction in the soft tissues with a thickening of the synovial membrane, marked hypertrophy of the villi, and, finally, destructive and regressive changes in the adjoining cartilage.

An interesting lesion which we have observed in cases of chronic proliferative arthritis, and which has not been emphasized by others, is a peculiar change in the synovial cells. We do not look upon this lesion as specific, but, because it occurs commonly and from the histological standpoint so closely resembles the proliferative changes of the synovia in acute rheumatic polyarthritis, of the endocardium in the rheumatic form of verrucous endocarditis, and of the pericardium in acute and very early rheumatic pericarditis, it seems worth while to describe it together with other synovial changes in greater detail.

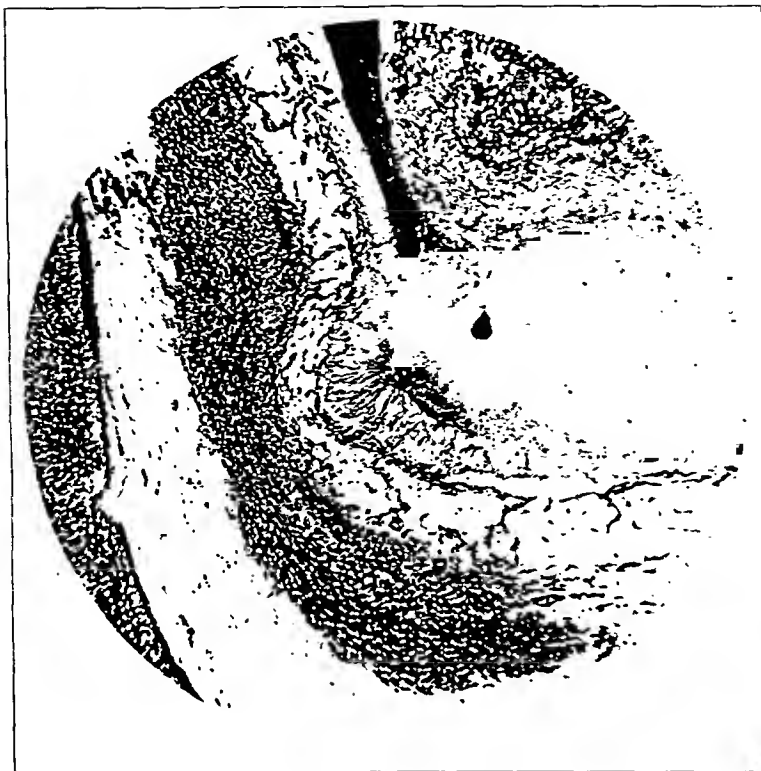


FIG. 4

Photomicrograph of portion of the synovial wall of the knee joint from a patient showing chronic rheumatoid arthritis. The most striking finding is the change in size, form, and arrangement of the synovial cells. They form a distinct palisade with the delicate free ends facing the joint cavity. The underlying tissue shows oedema, swelling of the collagen fibrils, fibrin, and a rich cellular exudate. The extensive capillary dilatation and hemorrhages are not readily seen in the photomicrograph.

We have placed tissue, taken immediately after surgical operation, into absolute alcohol, formalin, and Zenker's fixatives and have employed a variety of stains to bring out cellular as well as intercellular detail.

The villi are hypertrophic, increased in number, and papillomatous. They vary in size; some are large and coarse, while others are small and stumpy. The synovial membrane lacks uniformity. In some places there are no lining cells; in others there is only a single, somewhat flattened row. The most striking change in these cells is an alteration in form and arrangement. One sees stretches of synovial cells arranged in several layers; the individual cells are elongated, spindle-like, and form a palisade, with long parallel processes extending at right angles to the joint cavity and producing a striking resemblance to bronchial epithelium. A delicate layer of fibrin may lie along the free ends of these cellular processes, extending as fine threads down between the cells. These hypertrophic synovial cells have a bluish cytoplasm and large round or oval pale-stain-



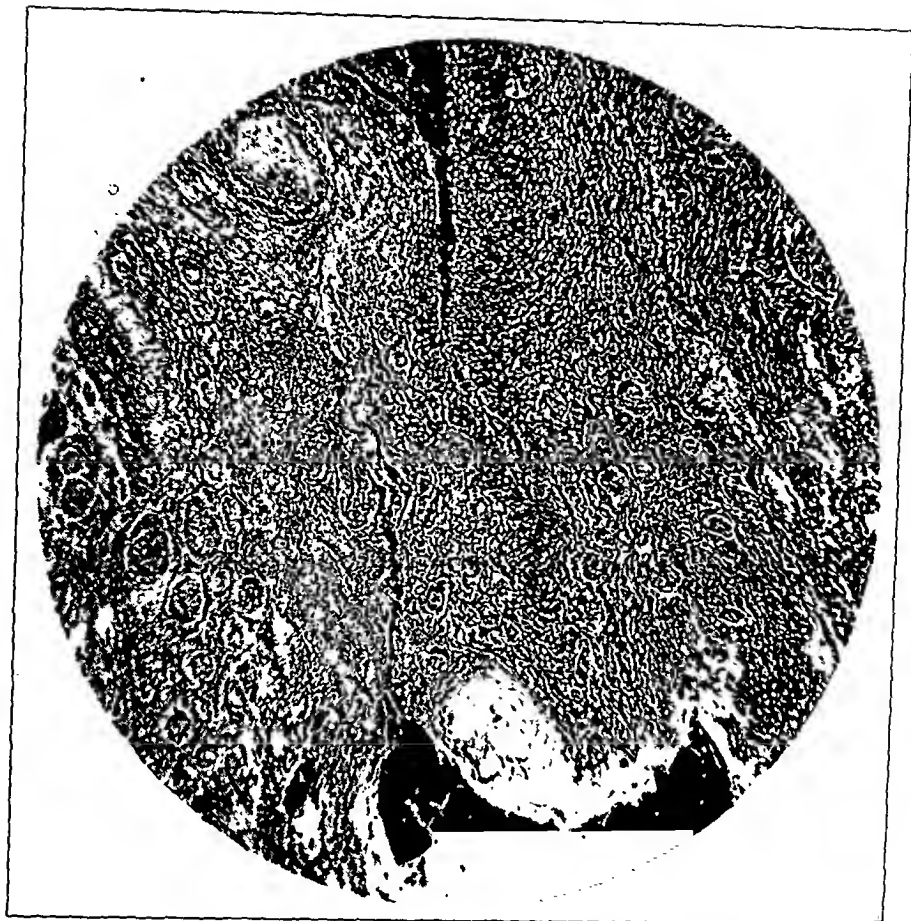


FIG. 5

The synovial membrane from the knee joint of a patient showing tuberculous synovitis. Two tubercles are clearly visible. The remaining picture so closely resembles the histological findings of the synovia in rheumatoid arthritis, with capillary dilatation, oedema, hemorrhages, cellular exudate, fibrin in the stroma, swelling of the collagen fibrils, and the palisading of the synovial cells, that both conditions may be scarcely distinguishable.

ing nuclei. Cells showing mitotic figures, amitotic nuclear division, and multinucleated cells are common among them. Lying between these cells is a delicate reticulum which can only be seen by the silver-impregnation method of Beilschowsky. These synovial cells take the methyl-green-pyronine stain of Unna-Pappenheim, but not as intensely as do the plasma cells. This layer of synovial cells usually rests upon a very vascular connective-tissue stroma. One may see small foci in the synovial layer where the cells are desquamated and pushed aside by coarse clumps of fibrin. Even more marked destruction is visible where hemorrhages and fibrinous exudate, accumulating just beneath the synovial wall, have cast off a complete layer of synovial cells, leaving a bare granulating surface capped with fibrin. A coarse fibrinous network may remain in the interstices of the connective-tissue stroma.

The second outstanding histological finding is the extreme vascularity of the newly formed connective tissue which resembles in places a diffuse capillary hemangioma. The lumina of the vessels are distended with red

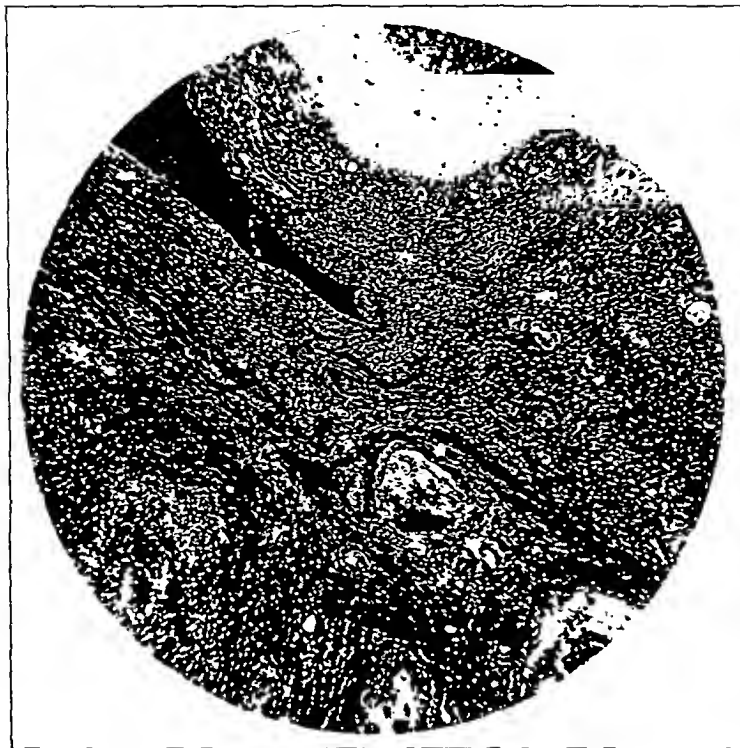


FIG. 6

Photomicrograph from knee joint of patient with rheumatoid arthritis. There is a striking hypertrophy and hyperplasia of the synovial cells, with giant-cell formation and palisading. There is a moderate cellular exudate, and many capillaries show fibrin thrombi. The presence of dilated capillaries associated with petechial hemorrhages in the stroma is not clearly visible.

blood cells and the walls are formed of a single layer of endothelial cells which, in the most recently formed vessels, are large and almost cuboidal. About older vessels are concentric whirls of fibroblasts and the narrow lumina of such vessels are sometimes scarcely perceptible. Here and there are fresh and organizing thrombi and papillary endothelial buds; occasionally one finds necrosis of large and small vessel walls with fibrin and red blood cells lying in the adjoining oedematous stroma. The larger vessels show an irregular subintimal proliferation of fibroblasts. Hemorrhages are very common, especially just beneath the synovial wall and along the margin of organization between clumps of fibrin and ingrowing granulation tissue.

The third striking feature is the presence not alone of perivascular foci of plasma cells, lymphocytes, and large mononuclear cells which often encroach upon the lumina, but also of many large lymph follicles with well developed reticular stroma and very active germinal centers. Some villi, bordered by a stratified layer of synovial cells and consisting simply



FIG. 7

Photomicrograph of an area from the pericardium of a child dying during an attack of acute rheumatic fever. The hypertrophy and dilatation, with palisading of the surface cells, resemble that described in the joints and along the endocardium in acute rheumatic fever, and suggest a reaction seen along the synovia in chronic rheumatoid arthritis. The vessels are dilated and show necrosis of their walls with fibrinous exudation. The stroma shows marked oedema and some swelling of the collagen fibrils.

of groups of lymph follicles, resemble at first glance tonsillar tissue.

The stroma of the villi is extremely variable,—in some areas it is diffusely sclerosed and composed of dense, relatively avascular connective tissue; in other areas it is oedematous and infiltrated with polymorphonuclear leukocytes, including eosinophiles. Here and there are areas in which the connective tissue shows regressive changes, infarction, necrosis, and calcification. Fat stains show fat as fine granules not alone in fibroblasts of the stroma and in clusters of mononuclear cells about vessels, but also in the collagenic ground substance itself. Iron stains show an abundance of hemosiderin.

This complex histological picture is simply one of a non-specific chronic inflammatory reaction showing regressive, exudative, and proliferative changes, but no structural lesion diagnostic of rheumatic infection.

#### DISCUSSION

A great deal has already been written concerning the relationship between acute rheumatic polyarthritis and chronic proliferative arthritis.

Příbram discusses the problem of joint deformities and cites the case of a child six years of age who, following an attack of acute rheumatic fever, developed intra-articular adhesions, false ankyloses, and contractures. In all of these early cases showing deformities, the evidence of a rheumatic origin of the joint lesion is based simply on the clinical history.

Another method of studying clinically the relationship between the two conditions in question is to determine the incidence of cardiac lesions in cases of chronic proliferative arthritis. Boas and Rifkin stated that valvular diseases, the result of an endocarditis, occurred in 17.5 per cent. of their patients with chronic multiple arthritis. They pointed out that Todd, as early as 1843, was probably the first to describe a case of arthritis deformans with associated cardiac lesions. Romberg also reported a case of chronic infectious arthritis showing valvular lesions. Charcot reported a considerable number of cases in which endocarditis had developed in patients with chronic rheumatism without ever having assumed an acute form. McCrae reported that of 500 patients with arthritis deformans 8 per cent. had valvular disease. The number of patients having cardiac lesions have been reported as follows: Blanc and Guyenot, 7 per cent.; Barjon, 21 per cent.; and Bannatyne, 17.9 per cent. How much weight should be attached to such statistical reports is difficult to determine for several reasons: first, because of the confusion which exists in the arthritic nomenclature, and, second, because reports based on a clinical examination independent of an autopsy are subject to error. However, admitting this possibility, the evidence does suggest that cardiac lesions have occurred with unusual frequency in this group of individuals.

In addition to a history of rheumatism and signs of endocardial damage, another important point in the link between acute rheumatic fever and chronic proliferative arthritis is the presence of rather typical subcutaneous nodules which may be found in both diseases. Hillier, in 1868, first drew attention to these structures, and Meynet, several years later, was the first to link them up definitely with cases of rheumatic fever. Since then these nodules have been the subject of much controversy. Cheadle and Garrod regarded them as the sole members of the group of rheumatic manifestations which appear exclusively in rheumatic infection. This is of interest because, if we have a lesion that is specific for rheumatic infection, and if this may be found in both types of joint lesions, it strongly suggests (if we are not dealing with the two conditions occurring simultaneously in the same individual) that the two diseases may be simply different manifestations of a similar fundamental process.

In the cases presented here the occurrence of the joint pathology is so closely associated with the onset and progress of the rheumatic fever that one cannot question its being a part of the rheumatic fever. It is also of interest to note that the joints clinically were identical with the joints of infectious (non-rheumatic) arthritis.

We have pointed out what a broad, non-specific term "chronic

proliferative arthritis" has become in present-day usage, which includes both the healed and progressive lesions of joints which are primarily inflammatory in type. Consequently, it seems justifiable to include the deformities following rheumatic infection among the other inflammatory lesions which comprise this group.

From our work and that of other investigators cited here, it would seem that the differentiation between cases of rheumatic fever with polyarthritic manifestations and chronic proliferative arthritis (non-rheumatic) is a problem for the clinician. In the light of our present knowledge, the cardiac findings are the chief determining factors. From a histological study of tissue from lesions that have definitely healed or have become chronic and progressive, the pathologist can offer little or no aid, and, in cases showing the characteristic subcutaneous or submiliary nodules, a differential diagnosis is not proved.

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# PARTIAL RESECTION OF THE ISCHIUM

## THE OPERATIVE PROCEDURE \* †

BY HENRY MILCH, M.D., F.A.C.S., NEW YORK, N. Y.

Resection of the ischium is a formidable procedure and appears to have been so seldom practised that it is not even mentioned in several standard texts of operative technique. However, the need for an adequate operative approach occasionally arises in the treatment of such conditions as malignant tumors, tuberculosis of the tuberosity or osteomyelitis of the body of the ischium. In the treatment of the latter condition during the past few years, the writer has employed an incision which seems to be adapted, both for the simple drainage of a localized infection, or for complete radical resection of the involved area of bone (Fig. 1). These cases will be described in detail on some other occasion.

It is apparent that the only satisfactory method is one which will permit the medial as well as the lateral aspects of the bone to be laid bare. Through the usual approaches, which visualize the lateral wall of the ischium, it is practically impossible either to drain an abscess, which has developed between the medial aspect of the ischium and the obturator internus, or to get sufficient exposure of the whole extent of the ischium and pubis to permit resection if indicated. Such an approach can be made only along the subcutaneous margins of the ischium and pubis, along the lateral boundary of the perineum. Through this region pass many important structures, the inadvertent injury to which might lead to serious consequences. As in any other complicated operation, these dangers may readily be obviated by a knowledge of the anatomy of the region.

Even a casual review will recall the fact that, with a few exceptions, the bony pelvis acts as a septum, separating the pelvifemoral from the perineal group of muscles. The lower edge of this septum is subcutaneous, from the pubic arch backward along the ramus of the pubis and of the ischium to the tuber ischii. Attached along the outer lip of these rami is the adductor group of muscles. Further up on the outer wall of the pelvis is the obturator externus, with its tendon passing backward beneath the edge of the acetabulum to insert on the femur. On the inner lip of the rami are attached the ischio cavernosus, the transversus perinei, and the constrictor urethrae. Higher up on the medial wall of the pelvis, running in a separate fascial compartment, Alcock's canal, are the internal pudendal vessels and nerves. Still higher is the attachment of the obturator internus and above that the arched fibers of the levator ani, forming the medial wall of the ischio rectal fossa. Posteriorly, beyond the tuber ischii, the pelvic outlet is completed by the lowermost overhanging fibers of the

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† Submitted for publication June 8, 1934.



FIG. 1-B

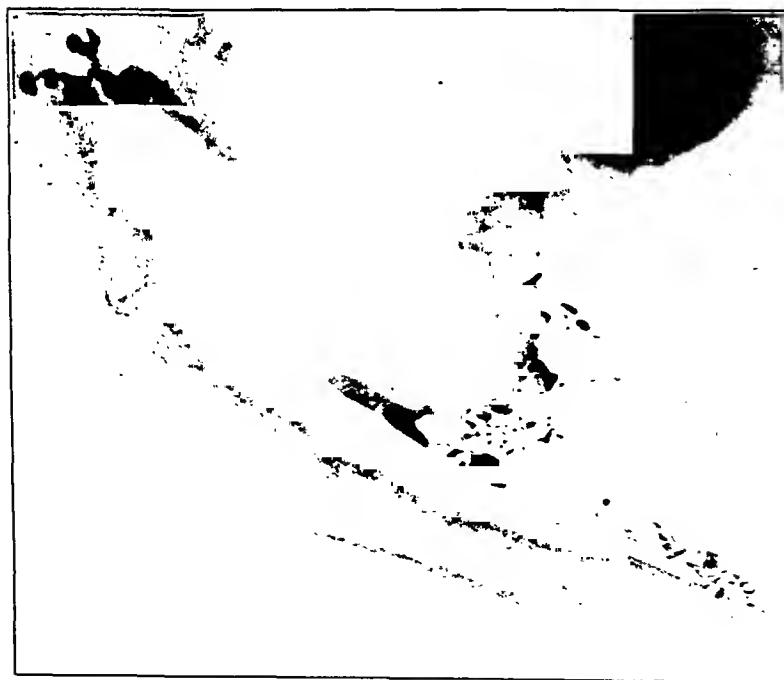


FIG. 1-A

Roentgenograms of case of osteomyelitis of the ischium, before operation (Fig. 1-A) and after operation (Fig. 1-B), showing area of bone resection. The shadow cast by the periosteal covering of the pubic ramus is still to be seen, though the body of the bone has been removed.



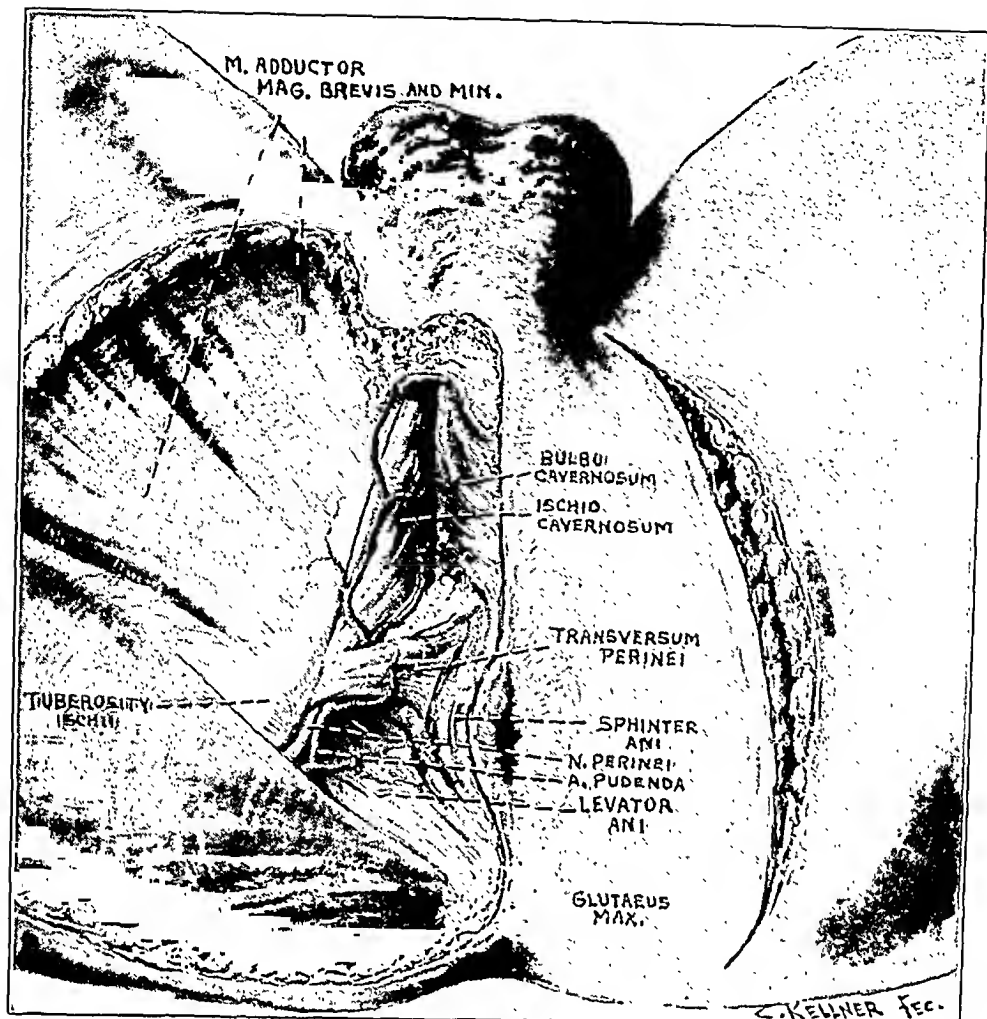


FIG. 2

Showing line of incision and superficial structures exposed.

gluteus maximus and the attachment of the sacrotuberous ligament to the inner margin of the tuberosity of the ischium. Lateral to this are the ischial attachments of the hamstring muscles. Still more laterally, and coursing downward between the tuber ischii and the trochanter of the femur, parallel to the hamstrings, is the sciatic nerve. Since the innervation of the hamstring muscles, derived from the sciatic nerve, occurs distal to the level of the tuberosity and from the outer side, an incision planned so as to be medial to these structures can cause no injury, either to the sciatic nerve or to its innervation to the hamstring muscles. The operation is most advantageously performed with the patient in the lithotomy position and with the buttocks elevated. However, if, as in the case illustrated in Figures 1-A and 1-B, the assumption of the lithotomy position is impossible, because of fusion of the hip, the lateral position may be employed, with only slightly greater difficulty. The tuber ischii, the inferior border of the body of the pubis, and the intervening subcutaneous rami are palpated. An incision is then made along this subcutaneous, bony ridge and is continued for about three or four inches posteriorly in the skin

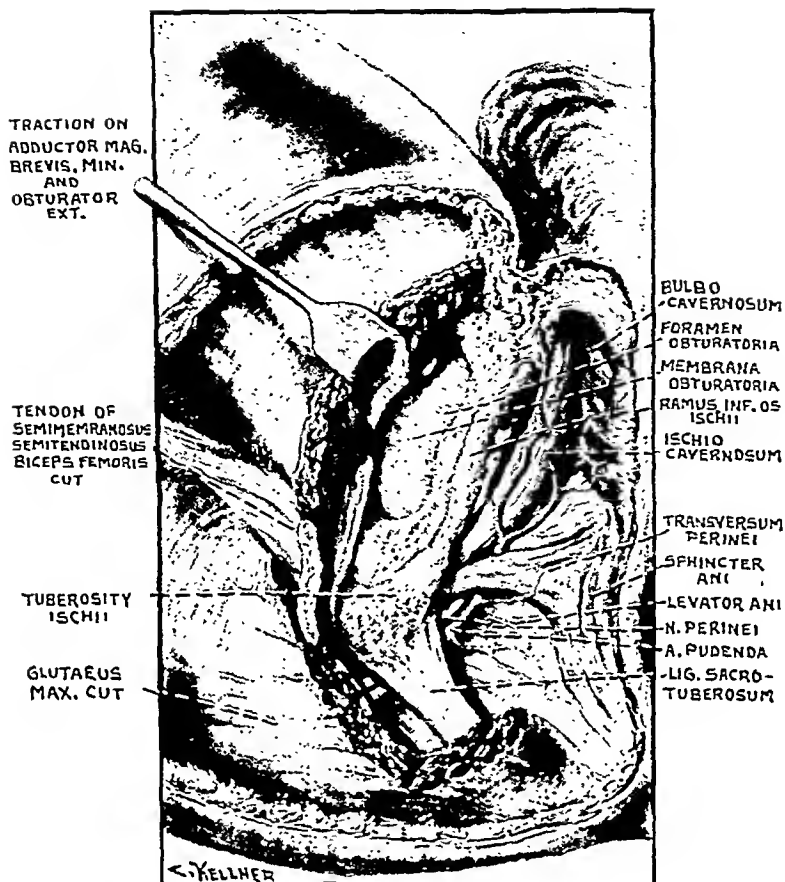


FIG. 3

Drawing from a cadaver, showing anatomical plan of the structures exposed in subperiosteal dissection of the outer surface of the ischium.

covering the gluteus maximus (Fig. 2). The lower edge of the gluteus is defined and is elevated with the finger, so that the fibers which overhang the tuber ischii may be cut across, exposing the tuberosity of the ischium, with the attachment of the hamstring muscles and the sacrotuberous ligament along its inner border. At this margin, between the two last mentioned structures, the periosteum over the tuber ischii is incised. By a subperiosteal dissection, the hamstring muscles are detached and displaced laterally (Fig. 3). The periosteal incision is then carried forward along the rami of the ischium and pubis in the line of separation between the adductor muscles laterally and the perineal structures medially. As the procedure is carried forward, the adductor magnus is separated and displaced laterally, until the lower external portion of the bone is exposed. Proceeding deeper into the wound, the adductors quadratus, brevis, and longus, and finally the obturator externus are separated, exposing the lower rim of the obturator foramen, and displaced outward in one large

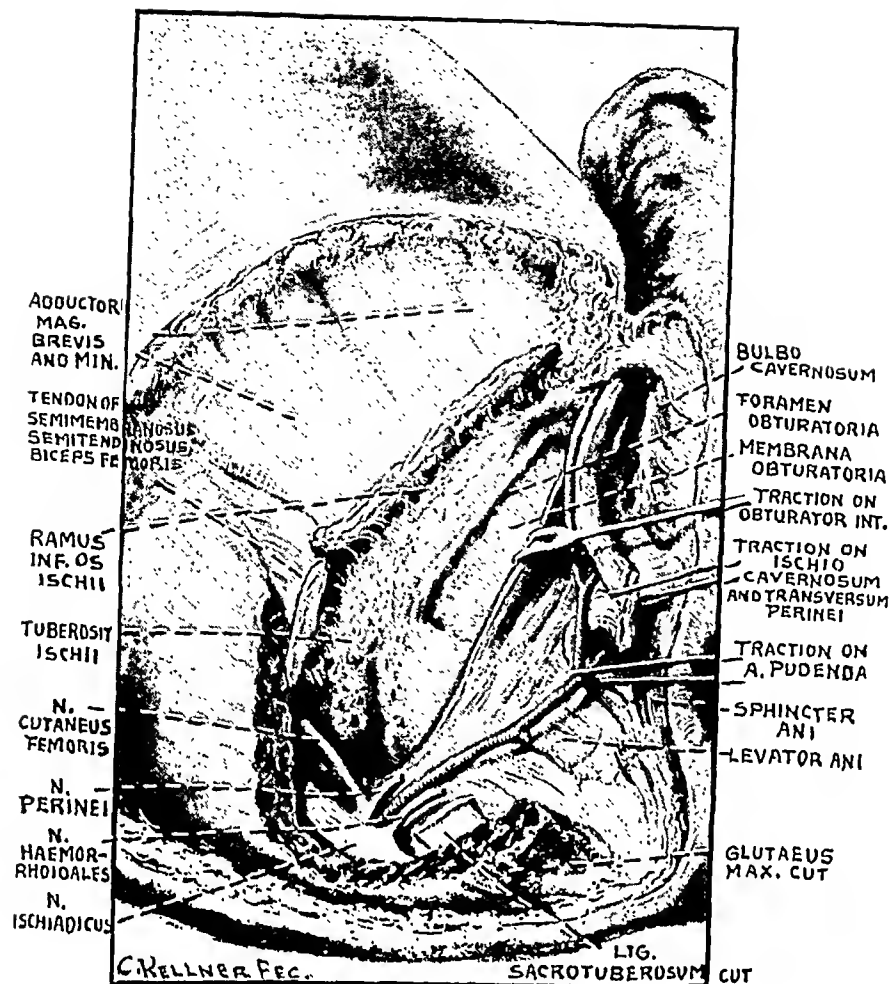


FIG. 4

Showing the anatomical plan of structures exposed in subperiosteal dissection of the inner aspect of the tuberosity and ramus of the ischium.

flap, which contains the sciatic nerve. During the course of this dissection, no important structures are met with and no serious hemorrhage need be feared.

The exposure of the medial wall is rendered only slightly more hazardous by the presence of the internal pudendal vessels. However, if, after separating the superficial structures, the ischiocavernosus, and transversus perinei, the dissection is kept strictly subperiosteal, the pudendal nerve and vessels will be elevated without any danger, and the lower fibers of the obturator internus will be exposed in the depths of the wound. These can now be raised, freeing the whole of the lower margin of the obturator foramen. In the posterior part of the incision, the attachment of the sacrotuberous ligament is now sharply cut away from the tuber ischii, and the lesser sacrosciatic foramen is opened. Here care must be exercised to avoid injury to the pudendal vessels, as they wind around the spine of the ischium (Fig. 4). With caution, they may be subperiosteally freed and displaced off the spine, so that resection may be carried out at or above the level of the spine. For the most part, however, the inferior margin of the

spine, which can be readily seen or palpated, should determine the upper level of the osteotomy of the ischial ramus. The area to be resected is now clearly exposed. A Gigli saw is passed through the obturator foramen and the pubic ramus is cut through. With the saw or an osteotome, the descending ramus of the ischium is cut on a line which runs from below the ischial spine beneath the lower rim of the acetabulum into the obturator foramen (Fig. 5). In clean cases, a layer-by-layer closure is performed. In infected cases, a large cavity is left, permitting adequate drainage.

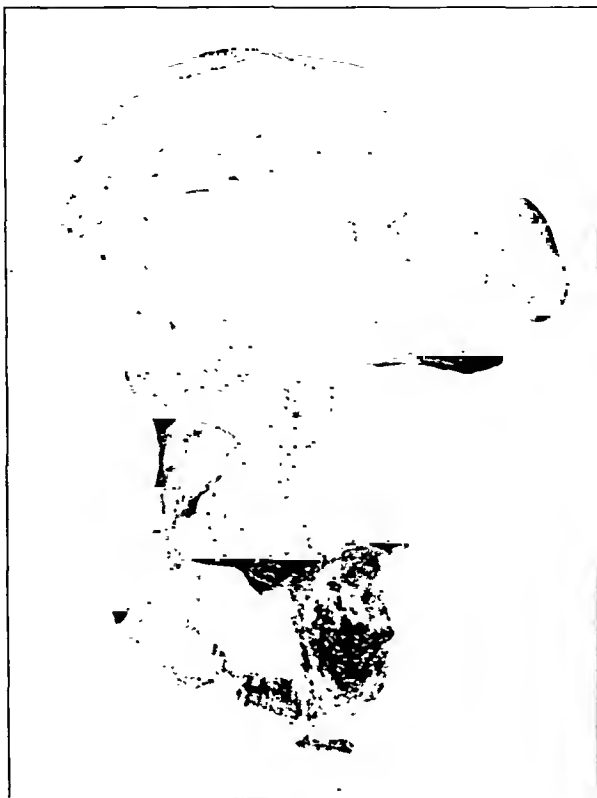


FIG. 5

Os innominatum. Shaded area indicates the extent of bone which may be removed in one piece through the procedure described.

Where only a small portion is to be resected, an aliquot part of the incision is necessary. For a resection of the tuberosity alone, the posterior part of the skin incision may be varied by making it in the gluteal fold, at right angles to the described approach. This exposes the fibers of the gluteus maximus, which may be either retracted or cut across to gain access to the tuberosity. The rest of the dissection is identical with that previously described for the posterior part of the operative field.

The procedure is particularly adapted for the treatment of affections which are localized, or which are not extensive enough to warrant interiliofemoral amputations. The only disadvantage of this procedure is that it involves an incision in the perineum and increases the risk of postoperative infection in the wound. Nevertheless, in consideration of the indications for this operation and of the relative ease with which the area may be exposed, this does not seem to be a valid objection.

## ANOMALOUS SYNOVIAL CYSTS \*

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Two synovial cysts, unusual enough to warrant description, were found in the course of the class-room dissection in this laboratory during the past year.

The larger cyst was located on the dorsum of the left hand of the body of a male laborer, aged twenty-nine years. It was not conspicuous on the surface although an oval body, measuring eighteen by fifteen by ten millimeters and located deep between the first and second metacarpals, was revealed when the superficial fascia was removed. Its wall was distinct, but of varying thickness, and could be easily separated from the surrounding connective tissue. Two diverticula, each about three millimeters in diameter, extended volarly from the bottom of the cyst. One ended abruptly after three millimeters, but the other pursued a rather long and tortuous course. It first turned volarly between the two heads of the first dorsal interosseous muscle and through the more proximal part of the transverse portion of the adductor pollicis. It then turned proximally, passed ventrad to the insertion of the flexor carpi radialis, and ended abruptly in the dense connective tissue of the volar carpometacarpal ligament about two millimeters distal to the medial side of the proximal articular surface of the first metacarpal bone. There was no gross communication with either the synovial membranes of the carpometacarpal articulations or the synovial sheath associated with the flexor carpi radialis.

The other smaller cyst was found in the hand of a Swedish sailor, aged seventy-six years. It was located on the medial side of the fourth left phalanx, just proximal to the first interphalangeal articulation, and formed a conspicuous surface swelling. It measured sixteen by ten by eight millimeters and was firmly attached to the sheath of the flexor tendons. Its wall could be separated from the surrounding connective tissue, but was very thin. The contained fluid was viscid, slippery, and somewhat opaque. When the sheath of the flexor tendons was opened, a transverse slit, about three millimeters long, was found in it immediately beneath the cyst. This slit did not affect the sheath, for the fluid could not be pressed from one to the other.

This cyst probably resulted from an injury to the fibrous tendon sheath. The size, the straight edges, and the location of the slit suggest that it was caused by a stab wound with a knife-like instrument. The opening in the fibrous sheath probably allowed the synovial layer to protrude, and irritation of the neck may have led to the obliteration of the

\* Received for publication May 14, 1934.

communication. The repair of the fibrous digital sheath would be delayed or prevented altogether because of the absence of coagulum in the slit and the presence of the neck of the everted synovial sheath.

Gosselin, in 1852, discussed the various theories concerning the development of synovial cysts or ganglia. The most generally accepted explanation was that they were herniated articular or synovial sheaths. Others believed that they resulted from a rupture of both the fibrous and the synovial sheaths, and some considered them as "tendinous bursae", but, as Gosselin pointed out, the shape of many of them invalidated this explanation. He noted that "sub-synovial corpuscles", by which he apparently meant small gray or white isolated cysts containing synovial fluid, were often found about but did not communicate with articulations, particularly the radiocarpal; and he suggested that these synovial cysts probably developed from deeper crypts of the articular synovial membrane by the obliteration of the communicating portion. The accumulation of synovial fluid within the crypts would form a cyst. Sheild, in 1887, reviewed these theories and proposed that violence or undue strain could cause an increased production of fluid or even the rupture of the fibrous sheath, thus allowing the "synovial sheath" to protrude. Spencer, in 1891, believed that a ganglion was usually produced "by a shutting off of a portion of a tendon sheath by inflammation". Féré, in 1902, noted that ganglia tended to reappear in the same family, thus suggesting a hereditary factor.

No evidence of the origin of the first cyst here described could be found. However, there is little doubt that the enlarged portion of it developed in a region of lesser resistance, by extension of a diverticulum into it. The long narrow diverticulum probably indicates the course taken by this portion of the cyst in reaching this region. The close proximity of the unexpanded end of the cyst to the carpometacarpal articulation suggests that it may have originated in this region, as Gosselin suggested, from a deep crypt of the synovial membrane of the carpometacarpal joint.

The author desires to express his appreciation to Dr. Meyer for calling his attention to these cysts and for inviting him to describe them.

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## THE PHYSICS OF RUSSELL TRACTION

# APPARATUS FOR THE TREATMENT OF FRACTURES OF THE FEMUR BY THIS METHOD

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In the past two or three years there has been a very wide-spread use of Russell's method of traction in the treatment of fractures of the femur. Very variable results have been reported from different clinics. The writer believes that at least some of the poor results are due to failure to take into consideration the actual physical laws involved in the application of traction to the thigh by this method.

The underlying principle is merely the application of two forces at the knee which tend to establish a resultant of their two pulls more or less in the axis of the femur. One force does not pull through the lower leg and another separate one hold up the lower fragment of the femur. Forces pull only in straight lines and when any two divergent pulls meet

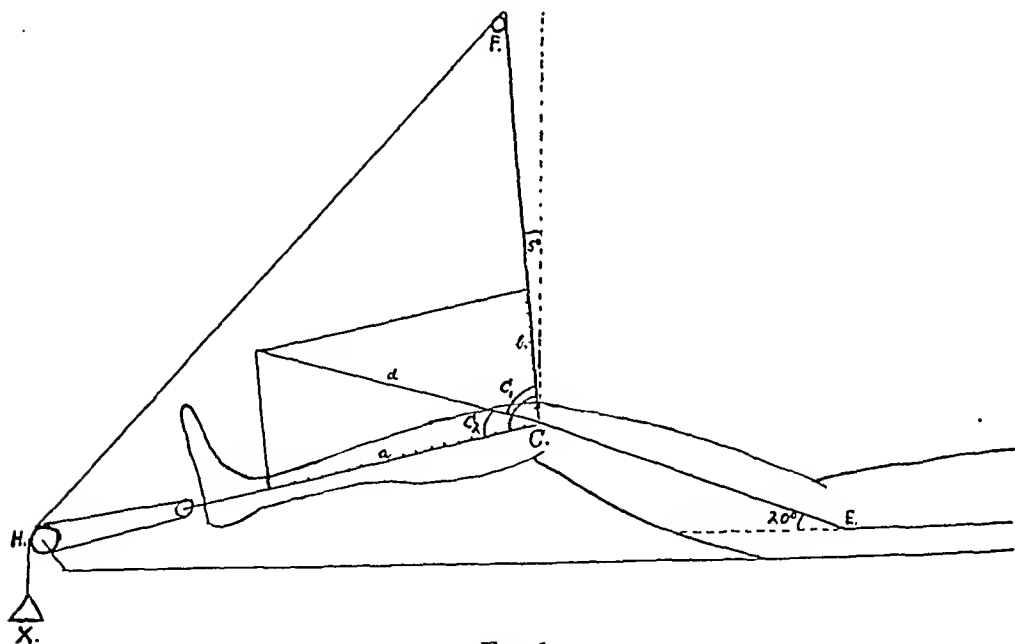


FIG. 1

Schematic arrangement of Russell traction to lower extremity.

at a point their forces are synthesized into a resultant according to definite physical laws.

Figure 1 illustrates a somewhat schematic Russell apparatus applied to the lower extremity. The center line of the thigh represents the femur and the line drawn down the middle of the leg represents the adhesive attached for traction. For simplicity the customary sling under the knee has been omitted. The bed is the base line of the figure. The

ropes are threaded through the double pulley at  $H$  to reproduce the forces of the original design of Dr. Russell.

The weight  $X$  acts on the knee  $C$  in a twofold manner. In the first place, it acts through the leg by a double system of pulleys and hence the weight is doubled. This force, here represented by  $a$ , is therefore equal to  $2X$  minus the friction of the system. In the second place, it acts through the overhead rope and is applied to  $C$  without duplication as the force  $b$  which is equal to  $X$  minus the friction. For the sake of simplicity the friction components may be neglected. If these forces are plotted on the lines  $CF$  and  $CH$  a parallelogram of forces can be constructed and the resultant  $d$  measured graphically. The direction of this resultant force can be determined by measuring the angles  $C_1$  and  $C_2$ .

A little study of this figure will reveal several rather striking facts.

1. The more acute the angle at which  $CF$  and  $CH$  meet at  $C$ , the greater will be the resultant  $d$ . This would suggest that to increase the pull on the femur it is merely necessary to shift the overhead pulley forward. This is undoubtedly true up to the point where increased obliquity tends to make the sling slip from under the knee.

2. Angle  $C_1$  is always twice  $C_2$ . In other words, as long as  $a$  equals  $2X$  and  $b$  equals  $X$  the resultant will fall one-third of the way from  $CH$  to  $CF$ . The problem is, then, to so adjust our apparatus that  $d$  will lie in the axis of the femur. Practically this can be most simply accomplished by raising and lowering the knee, thus automatically changing the angle between the thigh and the body at  $E$ . Conversely any change in the angle  $E$  raises or lowers the knee. Angular change at  $E$  will alter the direction of  $d$ , practically degree for degree. An increase at  $E$  drops  $d$ ; a decrease at  $E$  raises  $d$ . Trial and error have shown that the optimum angle at  $E$  is usually 20 degrees. In the average case this will throw  $d$  in the axis of the femur. The writer feels that it is necessary to check the direction of this resultant, and he has adapted a three-way, marine course protractor for this calculation. Figure 2 illustrates this instrument which has one arm fixed at zero and two swinging arms.

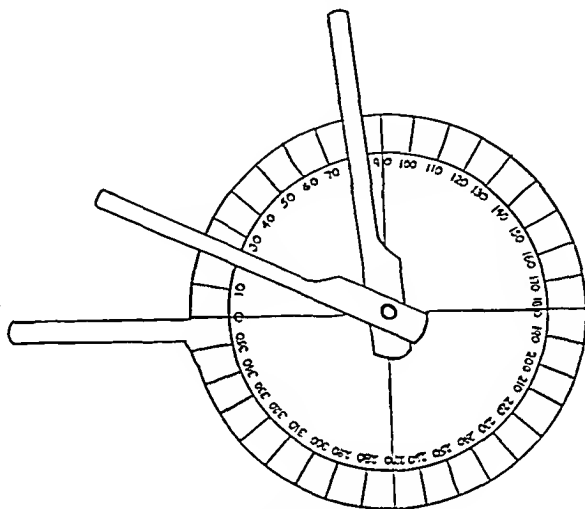


FIG. 2

Three-way marine course protractor graduated from 0 to 360 degrees.



3. The amplitude of the resultant  $d$  will always be less than the sum of  $a$  and  $b$  and, in general, it will be a little more than double the weight applied at  $X$ .

A practical application of these theories is illustrated in the roentgenograms in Figures 3-A and 3-B. This case, with the angular deformity and displacement shown in Figure 3-A, was seen in the third week of treatment. The angle between the thigh and body was 5 degrees. At the writer's suggestion this angle was changed to 20 degrees. No other change was made. Figure 3-B shows the improvement accomplished. At so late a stage it was not anticipated that the displacement of fragments would be affected. The decrease in angulation, however, represents a very real improvement.



FIG. 3-A



FIG. 3-B

Roentgenograms of fractured femur—lateral projection.

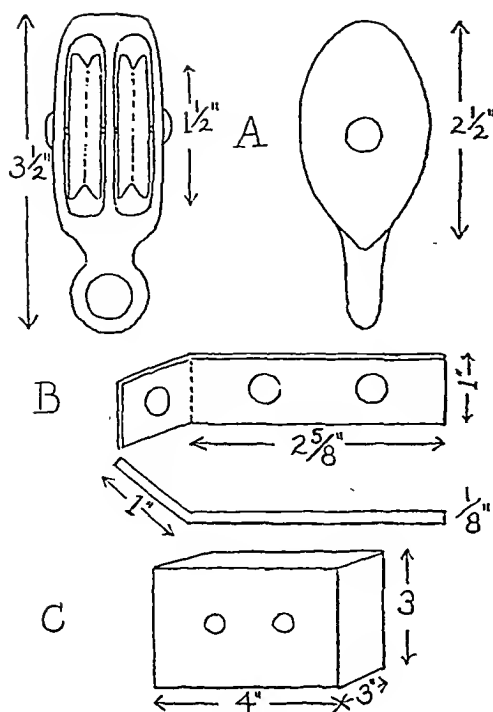


FIG. 4

Individual parts of apparatus.

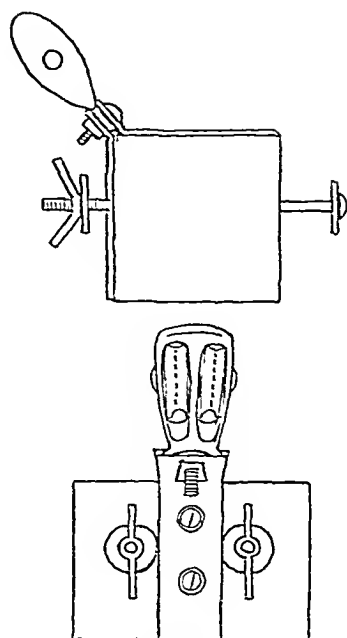


FIG. 5

Apparatus assembled.

A simple, inexpensive attachment for the treatment of fractures of the femur by the Russell method has been devised by the writer. This can be clamped to the cross piece of any standard Balkan frame. This arrangement has been used at the Beekman Street Hospital for several months and, in general, it has been satisfactory. The cost of materials and labor will not exceed one dollar in any locality.

As illustrated in Figure 4, the parts used are quite simple. *A* is a double marine pulley with one-inch sheaves. The shank of this pulley is rigid. It would undoubtedly be better to use one in which the shank is swivelled, but one could not be purchased. *B* shows two pieces of strip iron, one-eighth by one by three and five-eighths inches, bent as shown at an angle of 45 degrees, and drilled at three points in order that it may be bolted to the pulley and screwed to the block. *C* is a block of wood three by three by four inches. This is drilled at the points shown so that it may be clamped to the slotted cross bar of the Balkan frame by two long three-eighth-inch bolts with wing nuts.

Figure 5 shows the block, strips, and pulley assembled.

Figure 6 shows the application of the device to the standard Balkan frame, such as can be obtained in most hospitals. It will be noted that the threading of the ropes is a little different from the standard Russell method. However, this does not affect the forces or their resultant.

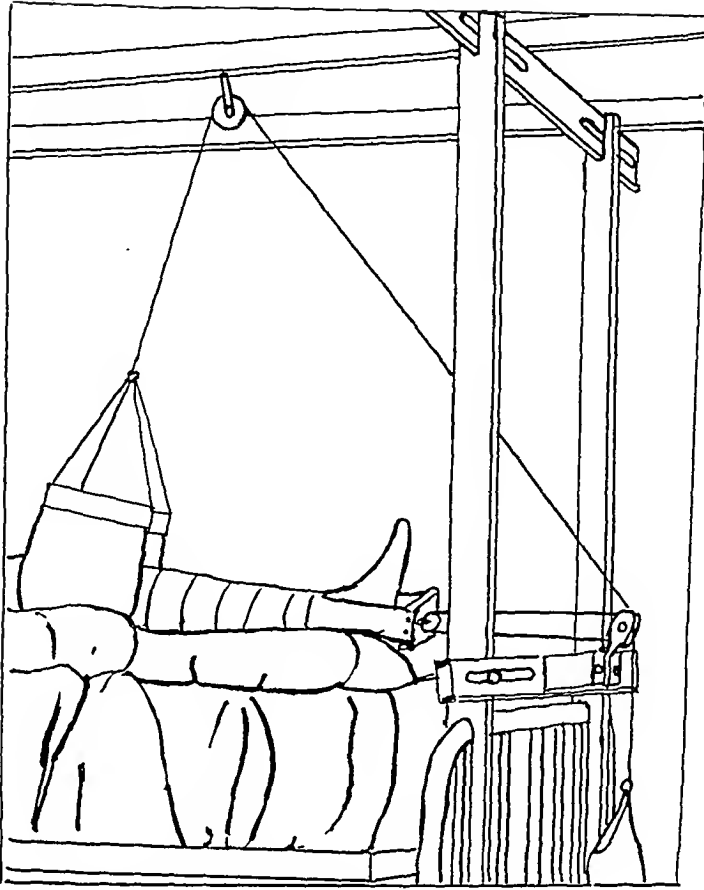


FIG. 6

Apparatus applied to lower extremity. View from below and to the right.

The height of the pulleys and the amount of abduction are entirely adjustable, and the three-inch block allows for the swing inward of the weights when the lower end of the bed is raised. There is no projecting apparatus to obstruct the lanes between beds as in most arrangements of this kind.

The writer is indebted for the design of this device to Mr. Louis Axclbank of the Engineering Staff of the Department of Hospitals of the City of New York. It was originally intended to have a pulley welded to a screw, which could be set into the block at 45 degrees, but this proved too expensive. If obtainable, this would undoubtedly give a more flexible apparatus.

## REVIEW OF THE END RESULTS OF FIFTY-SEVEN CASES OF SLIPPED UPPER FEMORAL EPIPHYSIS

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This deformity was first described by Fiorani as he had observed it in children, but E. Müller was the first to call attention to coxa vara as an acquired deformity of adolescence which, until that time, had been mistaken for tuberculosis and whose true nature was established by specimens obtained by excision.

In 1891, Royal Whitman published an article entitled "Fracture of the Neck of the Femur in a Child".<sup>1</sup> In 1893, another article was written by him on the same subject.<sup>2</sup> To him, therefore, goes the credit for designating the true pathology and deformity of the condition known as coxa vara.

Much has been written on this subject, not only with reference to this deformity, but on the subject of slipped epiphysis of the long bones in general, the most recent being the work done by Eliason and Ferguson.<sup>3</sup> In their series they had only two cases of slipped upper femoral epiphysis as compared to forty-eight of the radius and thirty-six of the humerus. At the Hospital for Ruptured and Crippled we find involved approximately an equal number of femora and humeri.

Our especial interest in this subject was first aroused when we had a so called "run" of cases of this character. Secondly, a large percentage of cases so diagnosed were found to be in the thin, tall type of individual, with no evidence of disease or disturbance of growth, and in the majority of cases there was a definite history of trauma with immediate onset of disability. In the third place, whether or not a good open or closed reduction had been attained, the postoperative x-ray seemed to bear no relation to the functional end results.

With these points in view, all available cases of slipped upper femoral epiphysis from 1928 to 1933 were examined, reviewed, and the x-rays reread.

The series comprised fifty-seven cases, thirty-one of which were treated on First Division and twenty-six on Second Division.

The cases treated were tabulated as to sex, age, type, hip affected, preoperative, and postoperative x-ray interpretation, history of injury, restriction of motion, pain, limping, shortening, type of operation, and functional end results.

End results were designated excellent when there was present no limping, pain, stiffness nor limitation of motion. Excellent results were given a grade of 100 per cent., each of the above symptoms being represented as 25 per cent. The cases classed as having good results were those in which one of these symptoms was residual, but was not sufficient to

TABLE I  
ANALYSIS OF CASES TREATED ON FIRST DIVISION \*

	Cases Treated		Male		Female	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Total number treated.....	31	100.0	19	61.3	12	38.7
Fröhlich type.....	18	58.6	8	44.4	10	55.6
Lean type.....	13	41.4	11	84.6	2	15.4
Right hip affected.....	13	41.4	8	61.6	5	38.4
Left hip affected.....	16	58.1	10	62.5	6	37.5
Both hips affected.....	2	6.4	1	3.1	1	3.1
History of injury.....	14	45.1	9	64.2	5	35.8
No history of injury.....	17	54.9	10	58.8	7	41.2
Limp present.....	31	100.0				
Pain present.....	29	93.5				
Restriction of motion.....	31	100.0				
Good reduction.....	17	54.8				

\* Average age was  $13\frac{1}{2}$  years; average date of beginning weight-bearing, 6 months. A Thomas brace was worn in 16 cases. In 4 cases, in which reduction was obtained by the closed method, the patients developed arthritis. A reconstruction operation was necessary in 3 cases.

TABLE II  
END RESULTS IN CASES TREATED ON FIRST DIVISION \*

	Cases Treated		Method of Reduction		
	No.	Per Cent.	Open	Closed	Open and Closed
Excellent.....	12	38.7	7	7	1
Good.....	3				
Fair.....	14	45.1	6	8	
Poor.....	2	6.4	1		1

\* Total good functional end results, 48.3 per cent.

interfere with locomotion, and the patient had improved and was satisfied. A reduction of 25 per cent., therefore, resulted in a grade of 75 per cent. for this group. Cases with fair end results were those in which two symptoms were still present, but the increasing deformity had been arrested. This group was given a grade of 50 per cent. Poor results represented those cases in which the procedure failed.

The findings in the cases treated on First Division are shown in Tables I and II; those in the cases treated on Second Division are tabulated in Tables III and IV.

There were three cases recorded in which a drilling operation was done and in which the results were not successful, in spite of the fact that true anteroposterior x-rays and measurements for anteversion or retroversion of the neck of the femur had been done preoperatively.

TABLE III  
ANALYSIS OF CASES TREATED ON SECOND DIVISION \*

	Cases Treated		Male		Female	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Total number treated.....	26	100.0	8	30.8	18	69.2
Fröhlich type.....	16	61.4	2	12.5	14	87.5
Lean type.....	6	23.0	5	83.3	1	16.7
Questionable type.....	4	15.3	2	50.0	2	50.0
Right hip affected.....	7	26.9	2	28.6	5	71.4
Left hip affected.....	17	65.3	6	35.3	11	64.7
Both hips affected.....	2	7.6			2	100.0
History of injury.....	13	50.0	6	45.4	7	54.6
No history of injury.....	13	50.0	2	15.4	11	84.6
Limp present.....	24	92.3				
Pain present.....	23	88.4				
Restriction of motion.....	26	100.0				
Good reduction.....	12	46.1				

\* Average age, 13½ years; average date of beginning weight-bearing, 6 months. A Thomas brace was worn in 4 cases. In 3 cases, in which reduction was obtained by the open method, the patients developed arthritis. A Brackett operation was necessary in 2 cases.

TABLE IV  
END RESULTS IN CASES TREATED ON SECOND DIVISION \*

	Cases Treated		Method of Reduction		
	No.	Per Cent.	Open	Closed	Open and Closed
Excellent.....	7	26.9	2	5	
Good.....	9	34.6	2	7	
Fair.....	8	30.7	3	5	
Poor.....	2	7.6			2

\* Total good functional end results, 61.5 per cent.

In five cases a bone-pegging operation was performed. Of these, two or 40 per cent. resulted in failure; beef-bone pegs were used in both cases. In the remaining three cases homologous bone pegs were employed and the results were classified as good.

#### CONCLUSIONS

1. Regardless of sex, the left hip was affected twice as frequently as the right.

2. There is probably no doubt that rickets, osteomalacia, or osteochondritis play a part as a predisposing factor in some cases, but twenty-seven patients in this series had a definite history of injury, nineteen of whom were classified as non-Fröhlich in type with no evidence of disease. This leads one to believe that trauma as the sole causative factor in the production of slipped epiphysis plays a more important rôle than we are

prone to think. Perhaps this type of case should be termed "epiphyseal fracture" rather than all of them being designated as cases of "slipped epiphysis".

3. Unilateral epiphyseal fracture or coxa vara in normal healthy individuals is usually the direct result of injury; while in cases of bilateral epiphyseal fracture there is usually a constitutional predisposition to displacement.

4. In nineteen or 35 per cent. of these cases, there was no evidence of endocrine imbalance or rickets.

5. A year or eighteen months is not a sufficient lapse of time to permit a definite statement as to the functional end result.

6. The postoperative x-ray is not a criterion of the end result.

7. Perfect reposition of the head on the neck does not insure normal growth.

8. Open operation gave better results in cases in which symptoms had been present for four months or over, as evidenced by the fact that of sixteen cases a good result was obtained in ten or 62.5 per cent.

9. The open operation of choice at the Hospital for Ruptured and Crippled is resection of the epiphyseal plate; the closed operation preferred is the Whitman abduction method.

10. An open operation utilizing an homologous peg is indicated when manipulation and immobilization fail to prevent slipping. Heterogenous pegs are contra-indicated.

11. To drill the neck of the femur properly, exposure of the neck seems to be necessary.

12. With the exception of six cases, closed reduction gave only a fair end result in all cases in which there was a history of disability of four months or over.

13. A good postoperative end result at the end of four or five years does not signify a permanent one, as evidenced by the fact that four, or 20 per cent., of the patients operated upon in 1928 and 1929 complained of increasing pain, limping, or stiffness, or of all three, even though at discharge they were classified as having good results.

14. In twenty-seven of the fifty-seven cases of epiphyseal displacement of the upper end of the femur, trauma was the sole causative factor.

15. Abnormality of growth or endocrine imbalance, either separately or in conjunction, were designated as predisposing etiological factors in thirty-four of the fifty-seven cases.

16. Nineteen cases in which there were no signs of predisposing pathology were classed as cases of incomplete epiphyseal fracture of the neck of the femur, the exciting cause being direct or indirect trauma. This type of injury, if treated in the same manner as fractures in adults, — namely, by closed reduction, does not tend to develop increasing deformity. This deformity is dependent upon the activity of the patient, weight-bearing, and the physiological weakness of the epiphyseal line.

17. Closed manipulation by the Whitman method in any case in

which there was a history of less than four months' duration gave the best result. Of thirty patients so treated, twenty or 67.6 per cent. had good end results.

18. Bilateral deformities were treated according to the same principles as unilateral deformities.

19. Traumatic arthritis was seen to develop more frequently in the patients subjected to open operation. However, arthritis was also seen almost as frequently in those patients who were subjected to repeated stretchings and manipulations.

20. Taking into account the number of cases and the minor digressions in the postoperative routine, the end results on the two Orthopaedic Divisions show no significant variations.

#### SUMMARY

It is the author's belief that all cases are entitled to the benefit of the doubt and that an attempt at closed reduction should be made if disability is of less than four months' duration. If this fails, an open operation should be performed. In all cases of over four months' disability the patients are entitled to an open operation as a primary procedure except in selected cases.

The final word in the treatment of this deformity has not as yet been said. It seems certain that in the near future there will be advocated a method radically different from those generally accepted at present which will give a much higher percentage of good results and with less likelihood of trauma which leads to pathology and deformity in early or later adult life.

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# MALIGNANT SYNOVIOMA OF THE KNEE JOINT

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Tumors arising from various joint structures other than bone are quite rare. While there are a few references to known cases of different types of tumors (chondroma, angioma, lipoma, indefinite sarcoma) arising in and from joint structures, specific case reports are very few.

The name "synovioma" is given to a particular type of tumor which apparently has its origin from the capsule or synovial membrane of a joint or bursa. This type of tumor in a joint should not be confused with the infrequent capsular type of osteogenic sarcoma which is sometimes found in a joint, for the true synovioma is not an osteogenic tumor, although it has been stated that it usually has its origin at the point where the capsule leaves the periosteum, and Leila C. Knox, in one of the three cases to be reported by her, states that synovioma sometimes requires differentiation from periosteal sarcoma. Synovioma may invade bone, but does not produce an osteoid tissue or structure. The Registry of Bone Sarcoma of the College of Surgeons does not recognize this particular type of tumor in the classification of bone sarcomata, but the Registry has two cases in which a diagnosis of synovioma (F. W. Stewart) has been made. So far, there have been too few cases of this type of tumor to enable us to learn very much about its course and the result of surgical or radiation therapy. Apparently, in the majority of cases the tumor is quite malignant, and the course of the disease rather rapid in spite of any type of treatment, although in Knox's third case the patient is living two years after amputation of the leg. It is to be hoped that surgeons and pathologists will be on the lookout for this type of tumor, so that our present knowledge of this obscure lesion may be increased. It is with such an idea that we report the following case:

J. B. D., a male, aged twenty-eight years, was admitted to Emory University Hospital, March 31, 1934.

The patient gave an indefinite history of an injury to the left knee about one year previously. In December 1933, the knee began to swell and became painful. He consulted Dr. Jelks, of Jacksonville, Florida, who found that, in addition to the swollen knee, there was an enlarged lymph node in the left inguinal region. This node was removed under local anaesthesia and, upon microscopic examination, the condition was diagnosed as "very malignant fibrosarcoma". The patient received very heavy deep x-ray therapy over the knee, thigh, and inguinal region. Evidently the tumor was not radiosensitive as the knee continued to enlarge and became more painful.

On admission to Emory University Hospital, the patient's general condition was good; the physical examination was essentially negative except for the leg. The urin-

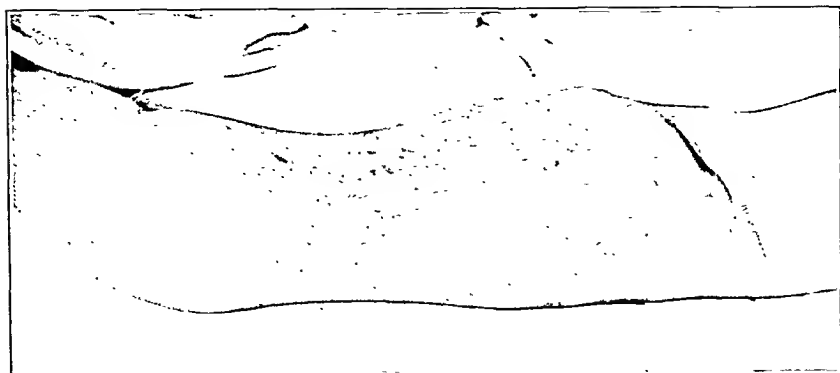


FIG. 1

Photograph taken May 1934, showing early metastases in the skin.

alysis and blood count were normal and the Wassermann test was negative. The left knee was distended with fluid and was symmetrically enlarged. (Fig. 1). Roentgenograms of the knee showed no evidence of any bone pathology. There was an irregular indurated mass in the inguinal region which extended up into the pelvis about one inch. The skin showed reaction to radiation therapy.

The knee joint was aspirated and about 100 cubic centimeters of straw-colored fluid was obtained. No organisms were found in this fluid. Two days later the knee was as distended as ever, and 150 cubic centimeters of bloody fluid was aspirated. As the joint refilled at once and as there was no relief of pain, the joint was not aspirated again. The pain was so severe that the patient required two to four hypodermic injections of morphine daily. The lymph stasis became more marked; the entire left leg was swollen from toes to groin; and the knee and the mass in the groin gradually enlarged. Metastases appeared in the skin of the thigh as little shotlike masses which rapidly enlarged to one-half a centimeter in diameter and which had a somewhat translucent appearance. Some masses became as large as two and one-half centimeters in diameter (Fig. 2). The skin



FIG. 2

Photograph taken six weeks later.



FIG. 3

Low-power photomicrograph of structure of inguinal metastases. ( $\times 205$ )

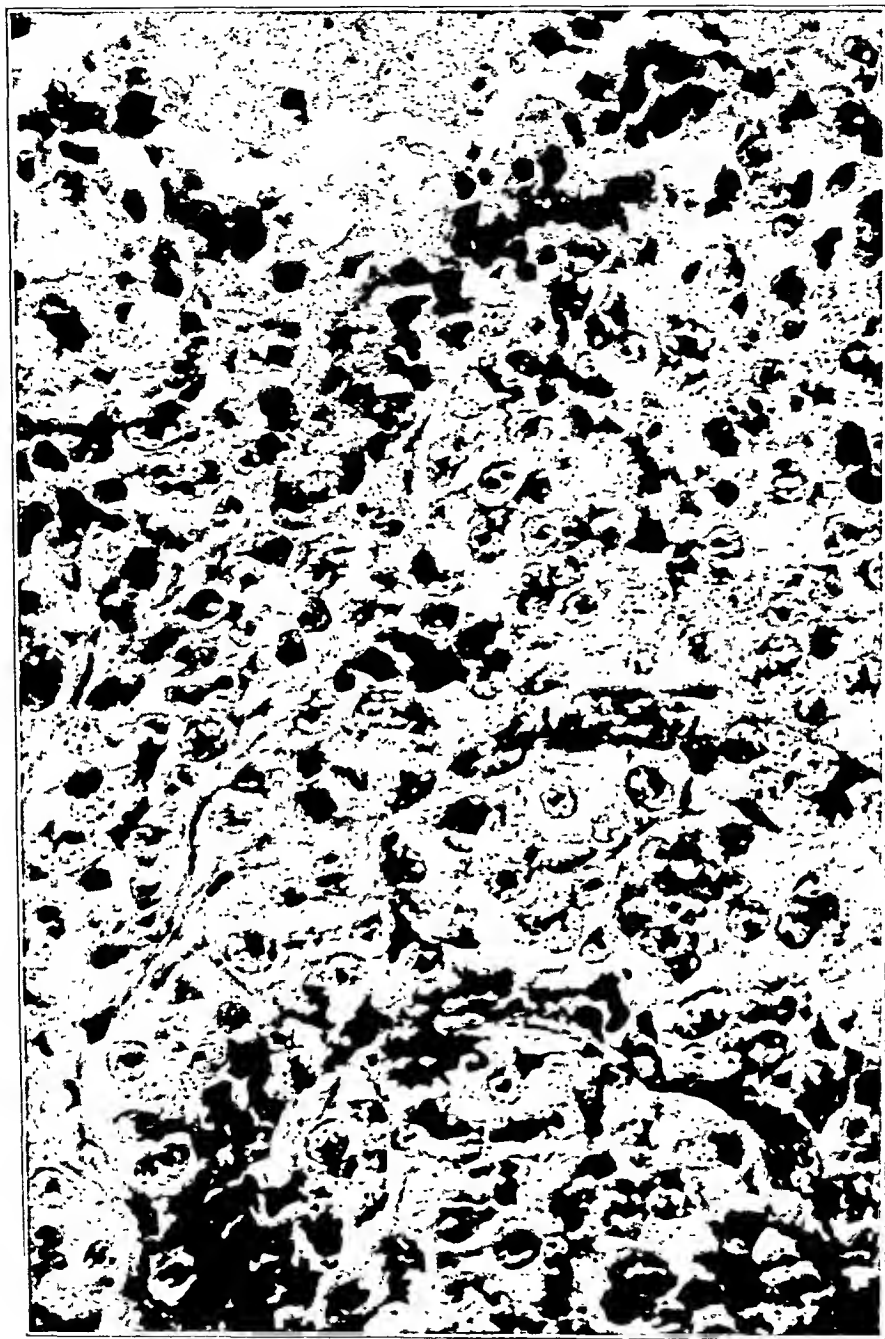


FIG. 4

High-power photomicrograph of structure of inguinal metastases. ( $\times 705$ )

broke down and there was a continuous serous drainage. Roentgenograms of the chest revealed no metastases, nor were any found in other parts of the body. One of the skin nodules was excised and, on microscopic section, showed essentially the same structure as in the original slide from the inguinal node. Coley's mixed toxins were used without any benefit. On account of the previous heavy radiation, the skin at this time could withstand no more of this treatment. Death occurred on June 26, 1934, seven months after the apparent onset.

Permission for autopsy was refused. A section of the metastatic node was obtained from Dr. Jelks for examination. Examined by one of us (E. L. B.), it was reported as follows: "Most of the lymphatic structure has been obliterated by a cellular neoplastic mass of hyperchromatic cells which are of a somewhat epithelioid type, being more or less rounded, with relatively large nuclei,—some with prominent nucleoli and with numerous mitoses [Figs. 3 and 4]. This type particularly appears in large sheets with much vascular injection. In other portions there is some acellular fibrous stroma and the neoplastic cells are polyhedral in shape and very deep in their staining reaction. A few areas suggest a branching formation with cells covering the pseudopapillae. In no areas are the cells of spindle or fibroblastic type, and giant cells are absent. There is no necrosis, hemorrhage, calcification, or evidence of osteoblastic origin.

This case is quite typical of many suspected bone tumors; the diagnosis cannot be made on any one particular bit of evidence, but all the findings must be taken together. The *clinical* picture suggests a bone tumor, but the roentgenograms show no evidence of bone involvement, and the section of the metastatic node also fails to show evidence of bony origin. It is certainly not fibroblastic; on the contrary, the type of cell suggests an endothelial origin. I, therefore, believe that this tumor is a 'synovioma' originating in the capsule and synovial membrane of the knee joint. The tumor is very malignant and histologically radiosensitive, although the tumor has apparently continued to grow in spite of the fact that the patient received heavy radiation to both the primary and metastatic tumors, the evidence of such heavy radiation being easily seen."

This case report presents several interesting and instructive features:

(1) An indefinite history of trauma eight months before discovery of the tumor. Such a history must not be taken *too* seriously for there are very few cases of tumor of bone, etc., which are not attributed to trauma. Nevertheless, such a relation between trauma and tumor should not be entirely ignored.

(2) A rapidly growing tumor which simulates clinically a primary bone tumor, yet x-ray fails to show any bone involvement.

(3) The early occurrence of metastases via the lymphatics, followed by skin metastases near the primary tumor.

(4) Comparative lack of response to deep x-ray therapy and Coley's toxins in spite of the histological evidence of radiosensitivity.

(5) Fatal termination after only seven months' duration.

# HODGKIN'S DISEASE OF THE SKELETON WITHOUT GLANDULAR INVOLVEMENT

## A CASE REPORT PROVED BY AUTOPSY

BY S. K. LIVINGSTON, M.D., F.A.C.S., HINES, ILLINOIS

Krumbhaar<sup>1</sup>, in 1931, reported a case of Hodgkin's disease confined to the skeleton and spleen without lymphatic involvement. A reasonable search of the literature reveals no other similar case report.

Ewing<sup>2</sup> states that a considerable group of cases, formerly classed as pseudoleukemia, present a specific histological structure which is now regarded as pathognomonic of Hodgkin's disease. This specific histology shows diffuse cellular hyperplasia with varying proportions of proliferating endothelial cells, endothelial giant cells, plasma cells, and eosinophilic leukocytes.

Ziegler<sup>3</sup> includes as Hodgkin's disease all conditions which seem to have any probable relation to the specific process. According to this classification, the term "pseudoleukemia" is merely replaced by "Hodgkin's disease". Thus Ziegler describes Hodgkin's disease as: (a) acute, (b) localized, (c) general, (d) mediastinal, (e) larval, (f) splenic, (g) osteitic, (h) atypical (intestinal form, Mikulicz's disease), (i) mycosis fungoides.

The following case differs from that reported by Krumbhaar in that the liver and not the spleen was involved; both cases had osteitic involvement. This case is reported because of the unusual manifestations of this disease.

### CASE REPORT

S. K. L., white, male, aged forty-one years, a cook, was admitted to the hospital for treatment of pain in the lumbar spine.

*Chief Complaint:* Pain in lower back, aggravated by motion and cough.

*Family History:* Essentially negative.

*Past History:* The patient had had the usual diseases of childhood and an appendectomy performed eight years previous to admission. There had been no symptoms referable to the spine.

*Present Illness:* Ten days before admission, while lifting a heavy bag of potatoes, the patient was thrown to the floor by a severe, sudden pain in the lumbar region, and was unable to rise. After this incident it was impossible for him to walk or stand, and confinement to bed was essential for relief of pain which was aggravated by motion. Pain was the only symptom.

*Physical Examination:* The general appearance was that of a well developed and well nourished male who, although not acutely ill, was suffering severe pain in the lumbar region. On examination, the patient could not stand or walk because of pain. When lying on his side, the lumbar lordosis was decreased; the erector spinae groups were spastic; and, on deep palpation and fist percussion, there was severe tenderness over the lumbar spine and sacro-iliac joints. There were no neurological signs.

*Laboratory Findings:*

Urinalysis:

Albumin—positive.

White blood cells—moderate number.

Benec-Jones bodies—negative.

Wassermann test—negative.

Kahn test—one plus.

Blood count:

Red corpuscles—4,600,000.

White corpuscles—10,000.

Hemoglobin—85 per cent.

Differential blood count:

Polymorphonuclears—70 per cent.

Small lymphocytes—21 per cent.

Large lymphocytes—9 per cent.

Blood chemistry:

Calcium—14.9 milligrams per 100 cubic centimeters.

Phosphorus—2.7 milligrams per 100 cubic centimeters.

*X-Ray Findings:*

Lumbar spine and hips:

An area of rarefaction in the left ischium suggests metastasis or cystic degeneration.

Skull:

Small, extensive, discrete, eroded areas throughout all portions of the skull, suggest a malignant process.

Long bones:

No anatomical or pathological variation from the normal.

Chest:

Cardiac image is apparently normal in size, shape, and position, showing no evidence of organic disease. Bony framework, diaphragm, and costophrenic angles show no abnormality. The lung fields are radiant throughout; the apices and peripheral zones are clear.



FIG. 1

Small, extensive, discrete, eroded areas throughout all portions of the skull, suggesting a malignant process.

Gastro-intestinal tract:

Physical condition of the patient prevented satisfactory examination.

*Clinical Tentative Diagnosis.* Metastasis to left ischium and skull; site of primary lesion unknown.

*Recommendation:* Symptomatic treatment, and further study.

*Treatment:* Deep x-ray therapy.

Left ischium: 200 kilovolts, 30 milliamperes.

Right, left, dorsal spine:

331 units, 1.0 ohm, 40 cm., 16.16 sq. cm., 6.8 seconds.

324 units, .5 ohm, 65 cm., 22.16 sq. cm., 12.2 seconds.

Shoulder posterior:

532 units, .5 ohm, 60 cm., 15.15 sq. cm., 10.6 seconds

Lumbar spine:

328 units, .5 ohm, 60 cm., 22.11 sq. cm., 10.4 seconds.

328 units, .5 ohm, 60 cm., 20.12 sq. cm., 10.4 seconds.

*Course:* The patient gradually failed and died after five weeks of treatment.

*Autopsy Diagnosis:*

1. Hodgkin's disease involving ribs, skull, pelvis, lumbar spine, and liver, without glandular involvement.
2. Bronchopneumonia, right base.

#### DISCUSSION

Bone-marrow lesions of typical structure are observed in generalized Hodgkin's disease, but, as a rule, the cortical tissue and periosteum remain intact.



FIG. 2

Showing multiple discrete areas of rarefaction in the left ischium.



Ziegler, however, believes that many peculiar osteal and periosteal lesions attributed to primary tumors of bone and marrow, or to obscure inflammatory processes, belong in this group, and he has collected a series of such cases, including myeloma with plasma cells, and lymphosarcoma, which he would class with Hodgkin's granuloma.



FIG. 3

Low-power photomicrograph of area from ischium, showing replacement and infiltration of marrow and bone by endothelial and foreign-body giant cells.

## CONCLUSIONS

1. Hodgkin's disease may be confined to the skeleton and liver without glandular involvement.
2. Bone-marrow lesions of typical structure are observed in gener-

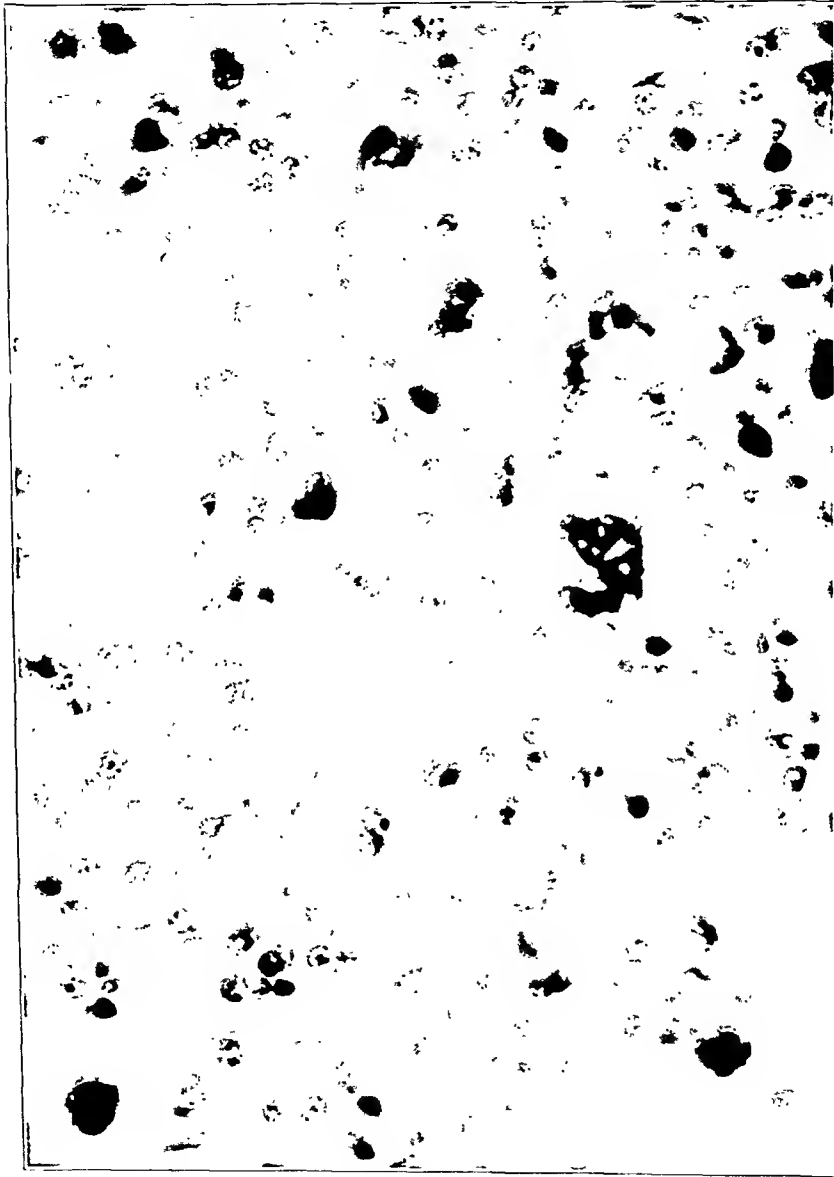


FIG. 4

High-power photomicrograph of part of area shown in Fig. 3, revealing endothelial and foreign-body giant cells, with Dorothy Reed cells in contrast.

alized Hodgkin's disease, but, as a rule, the cortical tissue and periosteum remain intact.

3. It is possible that many peculiar osteal and periosteal lesions attributed to primary tumors, or to obscure inflammatory processes, belong in this group.

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## OSSIFICATION OF THE INTERNAL SEMILUNAR CARTILAGE

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*From the Department of Orthopaedics, Kansas City General Hospital*

Ossification of a semilunar cartilage is a very rare condition, which only recently has been described as a clinical entity. The following case is reported as an example of this condition, and as a study in heterotopic bone formation.

A. W., a white male, aged twenty-four years, was admitted to the Kansas City General Hospital on January 22, 1934, with a chief complaint of pain and stiffness in the right knee.

The patient had had no difficulty until twenty months previous to admission. At this time, while riding a horse, his right knee was jammed against a corral fence. He had immediate pain and oedema, which subsided in a few days and which was not severe enough to keep him off his feet. However, the injured knee had given him trouble ever since the accident. Pain, oedema, and limitation of motion in ever increasing severity had occurred when the patient had been on his feet, until in the last six months he had become practically incapacitated.

On examination, the right leg presented one inch of atrophy of the thigh, but no shortening. The knee lacked about 15 degrees of complete extension and about 60 degrees of complete flexion. Motion was slightly painful. There was no hydrops, increased heat, or discoloration of the skin. There was a sense of fulness on the internal side of the infrapatellar ligament and in the joint line, but no definitely palpable mass. This area was about an inch in diameter and was extremely sensitive to pressure.

The roentgenograms (Fig. 2) showed evident calcareous deposits.

Preoperative diagnosis was possible hemangioma, with phleboliths, of the capsule of the knee joint.

On January 24, an exploratory arthrotomy was done. A small encapsulated tumor

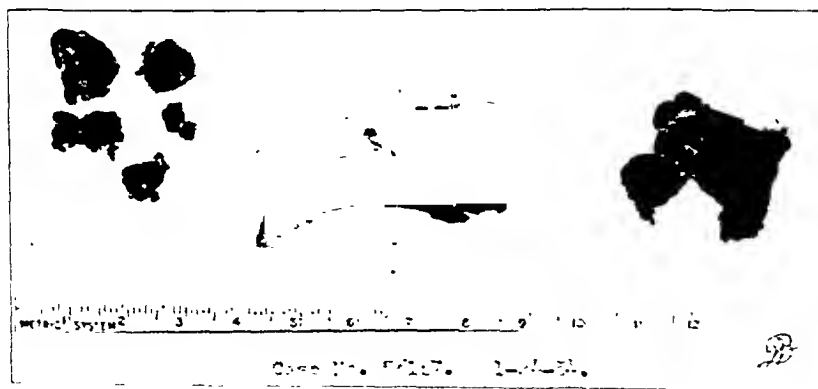


FIG. 1

Photograph of semilunar cartilage with tumor removed from knee. To the right, a portion of the infrapatellar fat pad. To the left, some material extruded from the tumor.

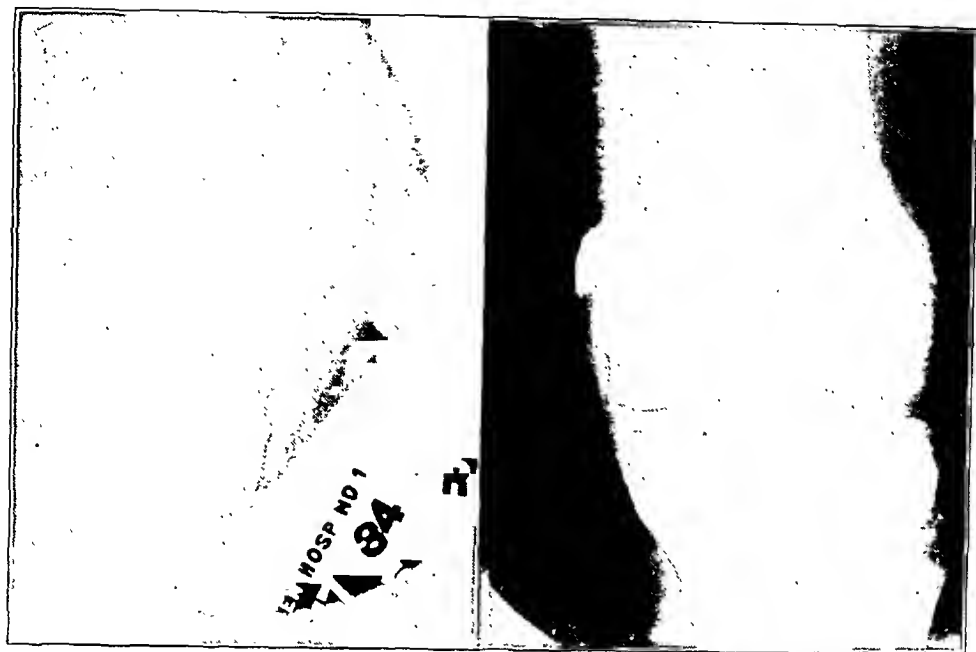


FIG. 2

Roentgenograms of knee before operation, showing evident calcareous deposits.

was found at the anterior end and homogeneous with the internal semilunar cartilage. This tumor was adherent to the joint capsule and made a small depression in the head of the tibia. The capsule stripped easily and the cartilage with the tumor was removed (Fig. 1). The infrapatellar fat pad was indurated and the synovia inflamed.

Recovery was uneventful and the patient now (April 1934) has a complete return of function, with no pain.

*Histological Pathology:* The section shows many irregular papillary processes, with dense cores of hyaline fibrous tissue. There are some dense masses of hyaline fibrous tissue, which closely resemble fibrillar cartilage. One portion shows calcified areas, associated with beginning bone formation, and some infiltration with mononuclear leukocytes. Osteoblasts and large multinucleated giant cells are seen adherent to the ossifying tissue. In other areas there is cartilaginous tissue in which secondary calcification is occurring and here, also, new bone formation can be recognized.

The author has been able to find reported in the literature only four cases of ossification of the semilunar cartilages. Burrows<sup>1</sup> reported two cases of ossification of the internal semilunar cartilage and Watson Jones and Roberts<sup>2</sup> reported two cases of ossification in the external semilunar cartilage.

The two cases described by Burrows were in males of nineteen and twenty-five years of age. Each patient attributed the beginning of his difficulty to a football injury received two and one-half years and five years previous to operation. Their symptoms were similar to, but of a milder nature than those in the case just reported. Watson Jones and Roberts did not give a detailed history of their cases, but mentioned that weakness, recurring effusion, "giving way" of the joint, and pain were the symptoms; these were not associated with arthritic changes or locking of the knee joint. In all four cases, relief was obtained after excision of the affected cartilage.

The author's case is quite similar as to symptoms and response to operation and is considered to be a true case of heterotopic bone formation. While the tumor mass made a depression in the head of the tibia, yet it was encapsulated and shelled out quite easily. No true connection with the bone could be demonstrated at operation or by examination of the specimen.

The mode of production of heterotopic bone is of interest. Leriche and Policard<sup>3</sup> have advanced a theory with the following steps:

1. Formation of the ossifiable medium. This is brought about by the degeneration of the connective tissue to an embryonic state on account of traumatic or infectious inflammation.

2. Calcium deposition and its resorption. All heterotopic ossification takes place in the vicinity of a calcified deposit at a point of phospho-calcific concentration.

3. Formation of heterotopic ossification. When an embryonic connective tissue, which has become ossifiable, and a collection of calcium

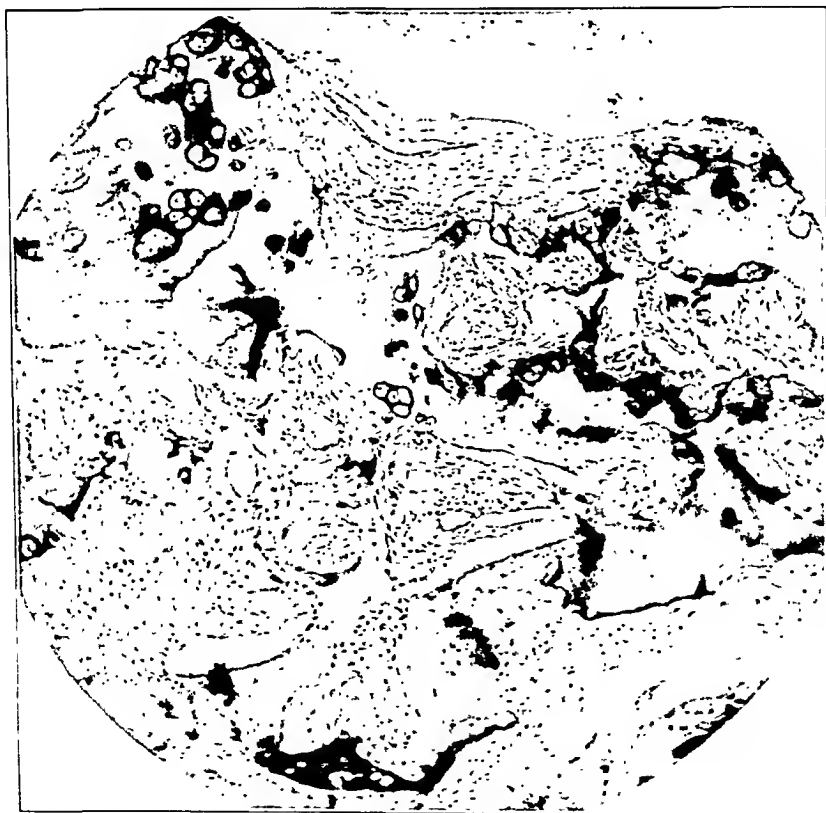


FIG. 3

Photomicrograph of histological section of tumor, showing new bone formation and small areas of calcification.

are brought together by chance, ossification takes place by the usual processes.

There were no calcium deposits in the four cases described in the British literature. However, Burrows believed that the ossification was a true heterotopic type after the theory of Leriche and Policard, due to the histological picture. Watson Jones and Roberts are of the same opinion and point out that eight cases of calcification of the semilunar cartilages have been described in the German literature,—an indication that calcification could easily be a precursor to ossification.

In the case just reported, however, both calcium and new bone are present (Fig. 3). Thus, all the steps in heterotopic bone formation as outlined by Leriche and Policard are present,—namely, trauma, irritative inflammation, reversion of connective tissue to embryonic state, calcification, irritation again, revascularization, and the formation of new bone.

The author is indebted to Dr. H. R. Wahl, Dean of the University of Kansas Medical School, and to Dr. Ward Summerville, for the preparation of the pathological specimen and the report.

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# OPEN REDUCTION OF OLD DISLOCATION OF THE HEAD OF THE HUMERUS: IMPORTANCE OF COMPLETE MOBILIZATION OF THE HEAD

## A REPORT OF TWO CASES

BY MARCUS H. HOBART, M.D., F.A.C.S., CHICAGO, ILLINOIS

*Attending Orthopaedic Surgeon, Cook County Hospital*

AND MONROE GARRISON, M.D., CHICAGO, ILLINOIS

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The purpose of this article is to stress the importance of complete freeing of posttraumatic adhesions in all operations for open reduction of the dislocated head of the humerus. We offer nothing new or unusual in the way of technique, but we do maintain that many of the unsuccessful open reductions can be traced directly to incomplete mobilization of the humeral head. One of us, while serving as resident in Orthopaedic Surgery at Cook County Hospital, had occasion to witness several unsuccessful reductions by the open method in which the head was apparently free, but no amount of manipulation would force it into the glenoid. In these cases, it would seem that some fibrous band, undiscovered by the surgeon, prevented reduction.

During the last ten years, the literature on this subject has been rather meager. The writers were able to find only nine articles during this period and some of these dealt with fracture-dislocation and excision of the head. The most recent article on this subject is that of Cubbins, Callahan, and Scuderi, published in February 1934. In this article, however, stress is laid on the fact, noted in experiments on the cadaver and in surgical trial, that the long head of the biceps, pulled taut by the dislocation, is the main factor in preventing reduction. Such has not been our experience. In our cases, this head was found intact in the bicipital groove, and, while tense, offered no impediment to reduction when the adhesions about the neck were freed. We do not, however, wish to state that this rule holds true in all cases; we are merely noting the results of our experience.

For the reduction of a posterior dislocation, McWhorter recommends a posterior incision through the deltoid, separating the infraspinatus muscle. He also mentions the importance of complete freeing of adhesions before attempting replacement of the head. Seudder, in his "Treatment of Fractures," mentions the presence of fibrous or osseous tissue in the glenoid as a possible factor in blocking reduction, as well as the taut, abnormal position of the head of the biceps, but there is no direct mention of adhesions about the anatomical neck. It must be remembered, however, that traumatic dislocation of any type is accompanied by



the formation of a hematoma, with subsequent invasion by fibrous tissue and the laying down of adhesive bands. These adhesions are not, as a rule, directly attached to the osseous tissue, but they frequently form an encircling band about the neck of the bone, as mentioned in Case 2, which effectually prevents reduction.

#### OPERATIVE TECHNIQUE

An anterior muscle-splitting incision is used and the capsule is opened longitudinally. The next step consists of removing all detritus and fibrous tissue from the glenoid, preserving the labrum as much as possible. Lane elevators are then placed under the surgical neck of the bone and the head is elevated. Manual palpation about the head and neck reveals the presence of adhesions; if adhesions are found they are divided with scissors. When the head is completely mobilized, it is lifted by means of elevators and forced into the glenoid by a moderate degree of traction and abduction. The arm is held firmly against the trunk during closure. The operative time in our two cases was thirty-two and forty-one minutes respectively.

#### REPORT OF CASES

CASE 1. M. M., a male, aged fifty-two, was seen at the Orthopaedic Clinic on June 1, 1931, with the complaint of pain in the left shoulder joint of six weeks' duration and inability to move the joint during the same period. The history revealed that the patient had fallen from a chair while intoxicated, striking his left shoulder. The following morning, he noted severe pain, swelling, and almost complete disability of the shoulder, but did not at that time or subsequently receive any form of treatment, believing the injury to be only a sprain. A diagnosis of subcoracoid dislocation of the left shoulder was made, and open operation was advised.

On June 3, 1931, he was admitted to the Orthopaedic Service of Cook County Hospital and open reduction was done. The patient was placed in the dorsal decubitus, with a sand bag under the affected shoulder and the hand drawn to the opposite side of the trunk. An anterior incision was made lateral to the junction of the deltoid and pectoralis major; the capsule was incised, exposing the head lodged beneath the coracoid and the glenoid and filled with fibrous tissue and detritus. Lane elevators were placed beneath the surgical neck of the bone, and the head was freed from adhesions around its entire circumference. The biceps tendon was taut, but had not been torn from its groove in the humerus. The detritus was cleared from the glenoid and the head was reduced with a moderate amount of traction and abduction. The arm was bandaged in the Velpeau position. The sutures were removed and passive motion was begun on the tenth day.

A fairly complete range of motion was present at the end of four weeks, after which the patient did not return. However, knowing County patients as we do, it would seem that he had obtained a good functional arm, else there would have been some complaint.

CASE 2. C. G., a male, aged fifty-five, was admitted to the Orthopaedic Service of Cook County Hospital on April 1, 1934, with the complaint of pain and disability of the right shoulder of three and one-half months' duration. He had fallen and supposedly had sprained his shoulder, for the injury had been followed by marked pain and disability. He had applied liniments locally and the pain and swelling had subsided, but the deformity and disability persisted.

Examination at the time of admission was essentially negative, except for the right shoulder which showed the deformity typical of a subcoracoid dislocation and marked restriction of abduction and external rotation of the arm.

Open operation was performed on April 3, 1934. The technique was essentially the same as that described in the previous case, but here the adhesions were more marked and there was one strong band binding the anatomical neck to the under surface of the pectoral muscles. This was divided with scissors, the glenoid was cleared, and the head reduced. The biceps tendon was still in its groove and was not disturbed. The arm was fixed in the Velpeau position. Sutures were removed and motion was begun at the end of the ninth day.

Almost complete return of function was present at the end of the fifth week.

#### SUMMARY

1. Many of the unsuccessful attempts at open reduction of dislocation of the head of the humerus are undoubtedly due to incomplete freeing of adhesions and only partial mobilization of the head of the bone.

2. Adequate exposure of the joint cavity and manual palpation and section of adhesions will, in the majority of cases, bring about reduction.

NOTE: Since this report was submitted for publication, one of the authors (M. H. H.) has operated on two other cases of old unreduced dislocation of the head of the humerus,—one with accompanying fracture of the greater tuberosity. The operative technique described above was used in these two cases and in both good results were obtained. Therefore, four cases in all have been operated upon by this method.

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## A LATERAL VIEW OF THE CLAVICLE

### ROENTGENOGRAPHIC DEMONSTRATION BY A NEW TECHNIQUE

BY HERMAN B. PHILIPS, M.D., NEW YORK, N. Y.

The clavicle is one of the few long bones examined frequently by x-ray, which, because of its anatomical relations, has hitherto afforded only a single view. A break in the routine of having two views, perpendicular to each other, is not desirable to the experienced, for it is only too well known that, while one view of a fractured bone may show perfect apparent apposition and alignment of the fragments, the other view, perpendicular to the first, may show significant displacement of fragments.

The clavicle is routinely examined by a postero-anterior exposure (Fig. 1) with the film placed against the clavicle. Unless pain or surgical dressings interfere, the patient is placed prone on the x-ray table, above and internal to the shoulder. This exposure should be modified a little by directing the rays slightly towards the head.

The new lateral exposure, which has proved valuable to the author and his associates, assures a view perpendicular to the slightly modified conventional one described above. The technique for obtaining it is as follows:

The film is placed slightly lower than in the exposure shown in Figure 1, and a small cone with long distance is utilized, affording a tangential view of the clavicular region. The tube-film distance should be about thirty-six inches and the angle to the feet varies from 25 to 30 degrees.

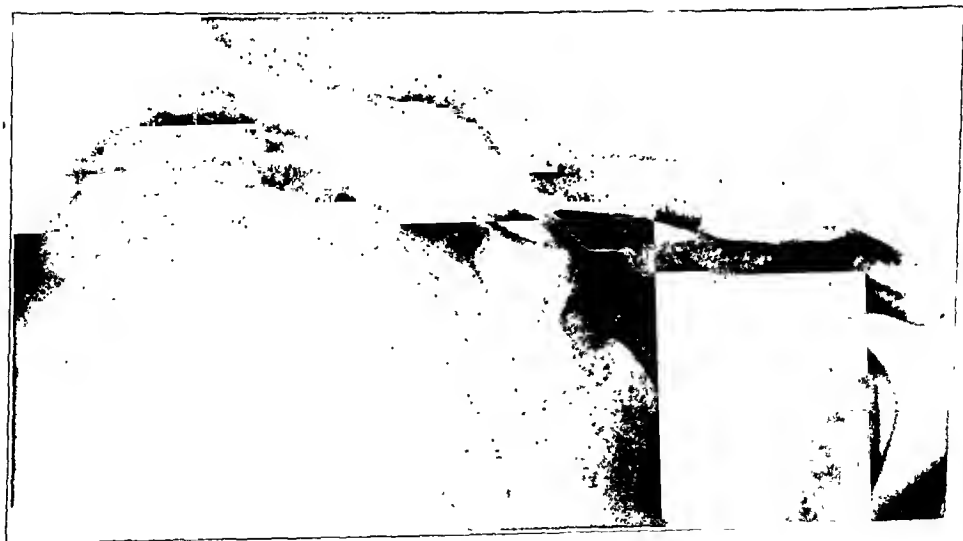


FIG. 1

Slightly modified conventional, postero-anterior view, showing fair apposition and alignment of fragments.



FIG. 2

Lateral view shows malposition of fragments, eliminates superimposed rib scapula, and most of soft-tissue shadows.

The position of the tube is several inches beyond the top of the head. The illustrations show the value of this additional exposure. Figure 1 shows fairly satisfactory position of the fragments, whereas Figure 2 shows malposition of the fragments with definite indications for correction. The second exposure is also valuable to eliminate superimposed shadows of the ribs, affording better definition of bony union than the conventional exposure.

In the case of a patient who is in too much pain to be placed prone on the x-ray table or whose dressings prevent him from assuming this position, the same type of roentgenogram can be obtained by having him lean against a vertical plate holder and making corresponding changes in the focusing technique.

# OSTEOCHONDROMA OF THE FEMUR

## A CASE REPORT

BY GASTON A. CARLUCCI, M.D., F.A.C.S., NEW YORK, N. Y.

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Benign bone tumors are encountered at all ages and in all the bones of the body. Because they are slow growing, or even remain the same size for many years, cause very little, if any, pain, and interfere rarely with the function of the limb or part affected, the afflicted patient goes through life in many instances without any need of surgical intervention. Occasionally, however, the tumor grows to such a size that it interferes with walking, as in the following case, and consequently it is necessary to resort to surgery. On account of the unusual features, a detailed report of this case is given.

Mrs. T. C., sixty-four years of age, a patient of Dr. T. Terragni, was admitted to the Columbus Hospital Extension on May 11, 1933. She had had a large tumor of the right thigh just above the knee for twenty-five years. Previous to admission it had grown somewhat and she found it difficult to walk or even stand without assistance. The patient was referred to the author for whatever surgical measures he saw fit.



The tumor was about the size of a football and had practically replaced all of the tissues in the lower half of the thigh. The patient could not stand unassisted (Fig. 1). It was found that she had a fairly severe case of diabetes, with a blood sugar averaging around 250 milligrams, and, considering her age, it was decided to leave her alone, as the tumor did not seem to cause her a great deal of discomfort.

The patient went home and returned September 12, 1933, four months later, at which time she complained bitterly of a gnawing pain in the right knee, which was made worse on the slightest motion of the joint. The tumor at this time did not seem much larger, but there were places that apparently were becoming softer and the skin was extremely thin over them. It seemed to the author that an amputation was justifiable, as he believed that shortly the tumor would break through with all the resultant complications.

She was treated medically for about ten days until the blood sugar was below 200 milligrams and then, under spinal

FIG. 1  
Osteochondroma of the femur.

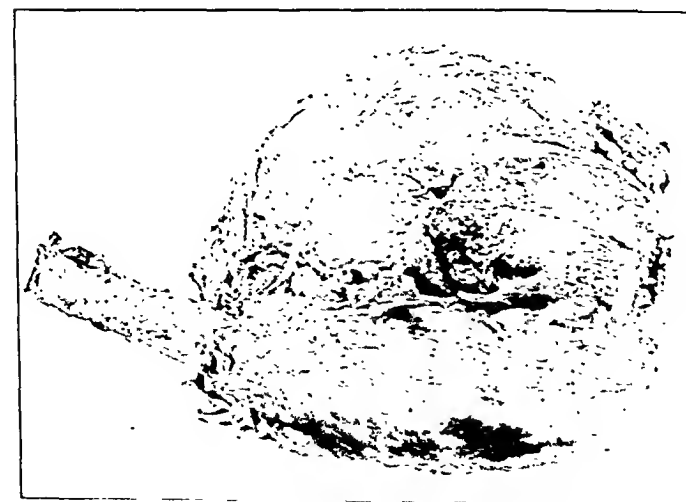


FIG. 2

Shaft of the femur ending in the tumor (osteochondroma) after the skin and muscles had been removed.



FIG. 3

Cross section of the tumor, showing pressure necrosis at the articulating surface.

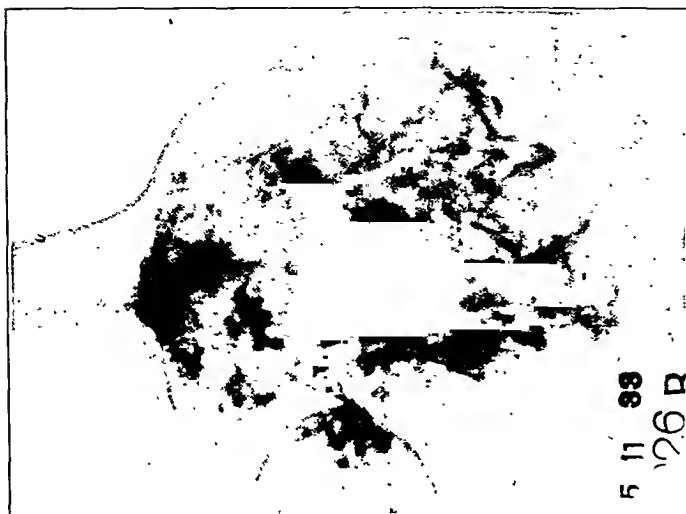


FIG. 4

Anteroposterior roentgenogram of the osteochondroma of the lower half of the femur.

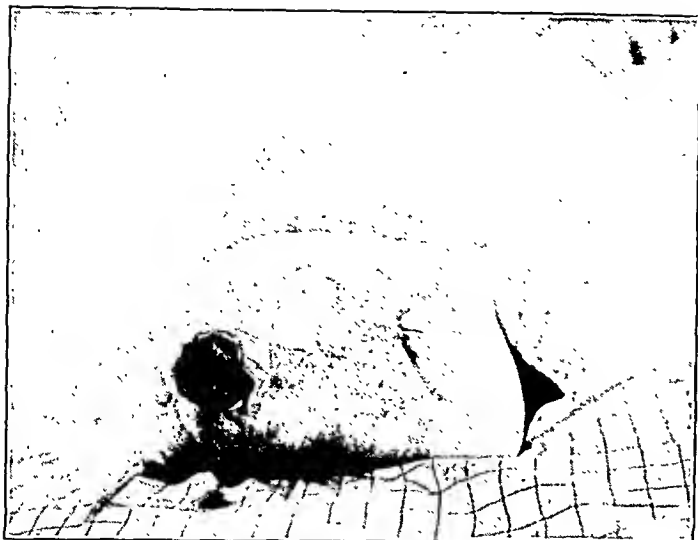


FIG. 5

Development of malignant growth (osteogenic sarcoma) in the stump of the femur.

The pathological report by Dr. Sala stated that this was a huge benign tumor (osteochondroma) measuring twenty centimeters in length and eighteen centimeters in width. It had replaced the whole lower half of the shaft and condyles of the femur, leaving only a thin stretched-out cortex of bone. The reason for the pain in the knee was

anaesthesia, an amputation at the upper third of the thigh was performed. Throughout the operation an infusion of about 2000 cubic centimeters of 5 per cent. glucose solution was given, with the proportionate amount of insulin, and the patient stood the shock of the operation very well, the pulse and blood pressure hardly changing. Convalescence was fairly smooth except for some sloughing of the posterior flap, which eventually took care of itself as soon as the diabetes was controlled. She left the hospital about October 1.

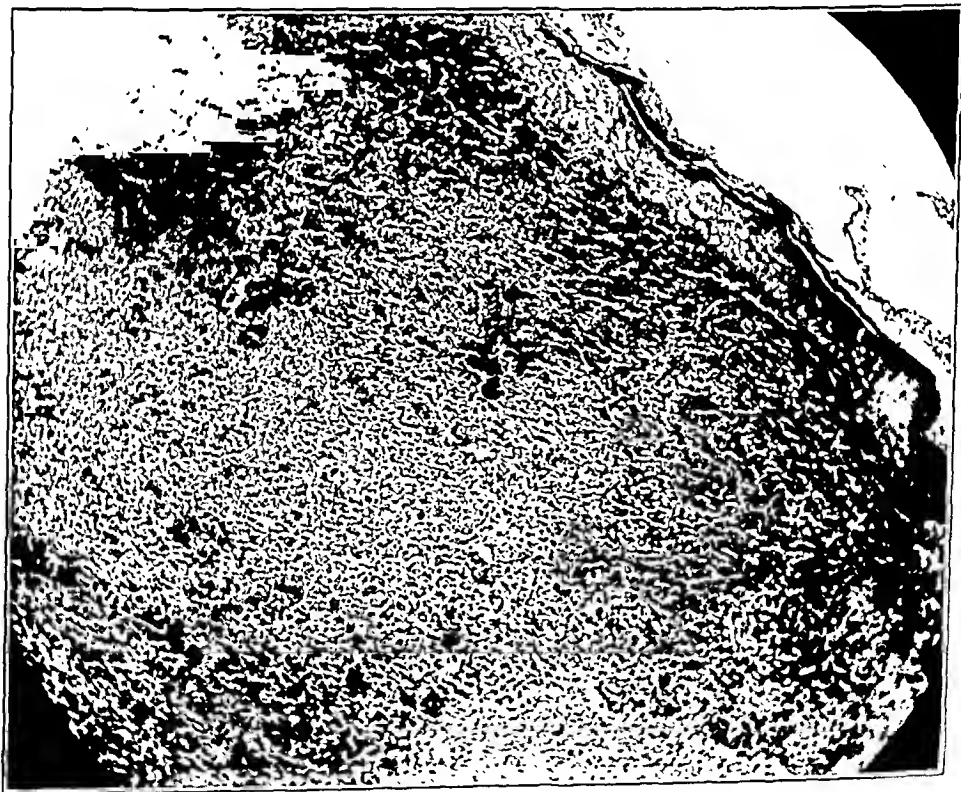


FIG. 6

Low-power photomicrograph of the osteogenic sarcoma developing in the stump of the femur.

explained by the fact that the tumor had grown downward so as to crush but not to invade the articulating surface of the head of the tibia (Figs. 2 and 3). The tumor itself on section appeared hemorrhagic with honeycombing cystic dilatations.

After the patient left the hospital, she remained under Dr. Terragni's care for diabetes and seemed to be progressing so well that the author presented the case at the Surgical Section of the New York Academy of Medicine in March. At this time she was getting around on crutches and the amputation stump was well healed.

About May 1, 1934, a dark-red swollen area appeared at the end of the stump which finally broke down. She was readmitted to the hospital on May 20 where she was seen by the writer and a tentative diagnosis of diabetic gangrene of the stump was made. After several days, however, in view of the fact that there was a protrusion of tissue and a steady bloody oozing, a section was taken for biopsy which was reported as strongly suspicious of a malignant tumor. On June 1, a deeper section was removed and this time Dr. Sala definitely reported it as an osteogenic sarcoma. A roentgenogram of the stump showed a proliferative bony process extending into the soft parts and an x-ray of the chest revealed that both lungs were extensively infiltrated with metastases. The patient died on July 20, just about two months after the new growth in the stump was first noticed.

This case is reported because of the unusual features associated with it. The patient apparently had had this tumor for well over twenty-five years and, in spite of her age and diabetic condition, she was able to withstand a high mid-thigh amputation and the wound healed firmly. The amputation was justifiable because the pain in the knee had become

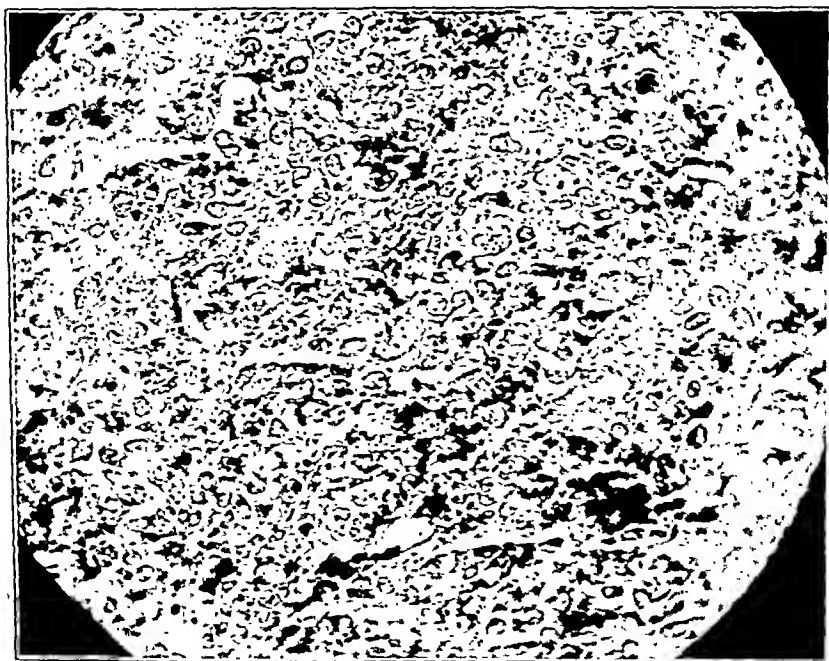


FIG. 7

High-power photomicrograph of the osteogenic sarcoma developing in the stump of the femur.



unbearable in spite of all medication. The specimen at that time was carefully studied for any possible malignant changes, but none were found. As can be seen in the photographs, at least two inches of the shaft of the femur was removed, together with the tumor, in order to get well above the tumor. In spite of this, about eight months later, an extremely malignant osteogenic sarcoma developed at the end of the femoral stump, which caused the patient's death within two months. However, this complication is by no means uncommon, as brought out by Geschickter and Copeland.<sup>1</sup>

1. GESCHICKTER, CHARLES F., AND COPELAND, MURRAY M.: Tumors of Bone. New York, The American Journal of Cancer, 1931.

# CONGENITAL HALLUX VARUS

## OPERATIVE CORRECTION \* †

BY DAVID SLOANE, A.B., M.D., NEW YORK, N. Y.

*From the Hospital for Joint Diseases*

Congenital hallux varus is a comparatively rare deformity; only twenty-four cases have been reported in the literature<sup>1</sup>, five of which were bilateral. The condition itself is more unsightly than disabling. The following case is reported because of its unusual interest.

The patient, a white male, age twenty, stated that as long as he could remember his right big toe had pointed markedly inward. He could not voluntarily bring his big toe over to its normal position, although it could easily be pushed over manually; it was only by this manoeuver that he was able to wear a shoe. In addition to this he had moderately severe congenital club feet; these may be disregarded except as they may play a rôle in the etiology of the hallux varus.

The appearance of the foot prior to operation is shown in Figure 1. The right big toe showed a varus deformity of forty-five degrees. The big and second toes were separated



FIG. 1  
Appearance of the feet before operation.

from each other by one inch at the base and by one and one-half inches at the tips. With the big toe in varus, there was five degrees of active flexion and twenty degrees of active extension at the metatarsophalangeal joint. When the big toe was pushed over into its normal position, flexion and extension became normal. There was a tight band of tendon-like tissue along the inner border of the big toe and foot, which tended to keep the toe pointing inward. The club-foot deformities are plainly evident.

\* From the Orthopaedic Service of Dr. Herman C. Frauenthal.

† Presented before the Clinical Society of the Hospital for Joint Diseases, New York, March 6, 1934.

*Operative Technique:* Under general anaesthesia, an incision ten centimeters long was made along the inner side of the right foot, extending from the proximal phalanx of the big toe to the middle of the first metatarsal. The tight band of tissue, which was primarily the abductor of the big toe, was severed. The big toe was then easily brought into its normal relationship with the rest of the foot. The metatarsophalangeal joint was opened medially and a small overhanging ledge of bone removed from the medial side of the metatarsal head. To prevent any possible recurrence, a drill hole was made through the head of the first metatarsal and the base of the proximal phalanx. Commercial fascia lata was drawn through the holes so as to form a secondary reinforcing lateral ligament for the metatarsophalangeal joint of the big toe. In addition to this the joint capsule was reefed through a small incision laterally. The joint capsule was then closed with chromic catgut and the skin with silk. The big toe was firmly bandaged against the foot. About three months after operation there was practically full return of normal flexion and extension of the big toe. The toe was held very firmly in its new position and could not be dislodged even with considerable force. The appearance of the foot at that time is shown in Figure 2, and the roentgenograms before and after operation are shown in Figure 3.

The question of the etiology of this condition is interesting. Greig's case<sup>2</sup> offers a valuable clue. He described a unilateral case in a boy of seventeen who had a very firm fibrous band of tissue, lying along the inner side of the adducted big toe and running from the phalanges to the base of the metatarsal bone. Roentgenograms of the foot showed the embryological remnants of an undeveloped secondary big toe. There were three osseous elements, representing the two phalanges and the metatarsal bone. There were also an accessory cuneiform and an accessory scaphoid. Greig explains the formation of hallux varus as a primary double hallux in which the medial toe (the accessory one) fails to develop beyond a certain stage. This acts like a taut bowstring on the normally developing lateral toe and gradually pulls it in toward the mid-line of the body.

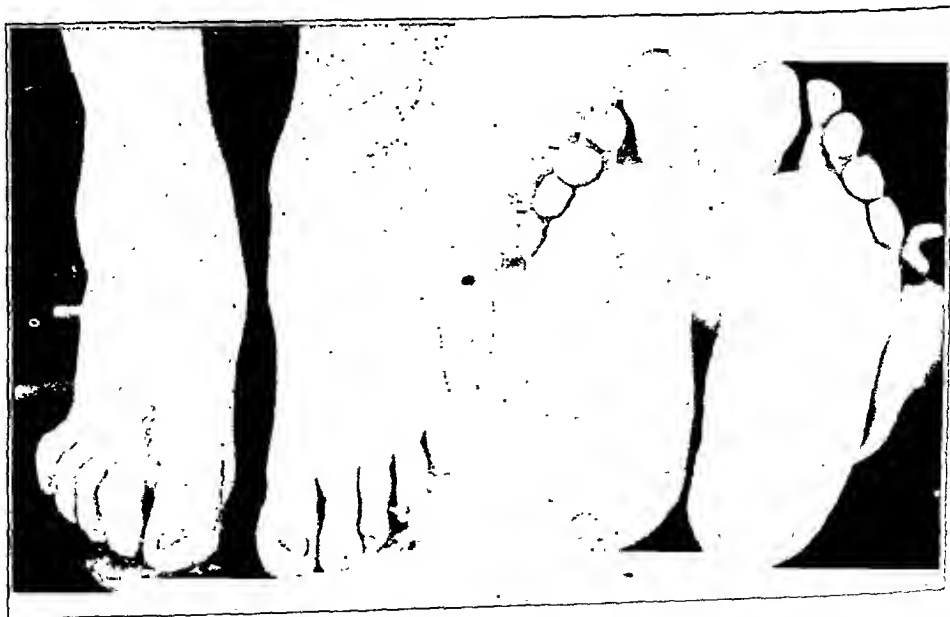


FIG. 2

Photograph taken three months after operation.



FIG. 3-A

Roentgenogram before operation.

FIG. 3-B

Roentgenogram after operation.

In the author's case there were no primordial remnants visible by x-ray; so the probable explanation is that the primary tightening of the tissues which caused the club feet also pulled the big toe into varus. Some relaxation of the metatarsophalangeal joint on the one side must also be presupposed because, while the patient had bilateral club feet, the hallux varus was unilateral.

## REFERENCES

1. SATZEPIN, T. S.: Ein Fall von doppelseitigem kongenitalem Hallux varus. *Zentralbl. Chir.*, LVII, 2484, 1930.
2. GREIG, D. M.: Hallux Varus. *Edinburgh Med. J.*, XXX, 588, 1923.

# IMPACTED FRACTURE OF THE NECK OF THE FEMUR

## A CASE REPORT

BY JOHN F. LECOCQ, M.D., AND EDWARD LECOCQ, M.D.,  
SEATTLE, WASHINGTON

The presence of true impaction in fractures of the neck of the femur has been questioned by many writers. Orthopaedic surgeons and others skilled in the treatment of bone and joint disabilities feel that true impaction occurs but rarely. Nearly all agree that the fractured femoral necks, interpreted from the roentgenograms as being impacted, are not true impactions. Only more accurate interpretation of the roentgenograms is required to establish the fact that nearly all of the so called impacted fractures are really not impacted. MacAusland, in a recent publication, states that true impaction of the fragments in these fractures does not occur.

However, true impaction in fractures of the neck of the femur may occur. An interesting case history is here presented:



FIG. 1

Roentgenogram showing impacted fracture of the neck of the femur.

H. Y., a girl, twenty years of age, was seen April 16, 1934. The patient walked into the office, unassisted.

*History:* About seven weeks previous to the date of this examination, the patient had fallen during a basketball game, striking the floor with the right side of her body.

Following the accident she had a considerable amount of pain in her right hip, and she required assistance when leaving the basketball floor. She was able to walk, however, and continued to do so. She had some pain at first, but this gradually subsided. She had a persistent limp on the right side. A roentgenogram, made the day following the injury, was reported to be negative.

*Examination:* The girl walked with a marked limp on the right side. There was present marked weakness of the gluteal muscles; the hip flexors and quadriceps were also weak. Measurements showed three-quarters of an inch of atrophy of the right thigh, one-quarter inch of atrophy of the right calf, and one-quarter of an inch of shortening in the right lower extremity. All hip motions were free except flexion which was somewhat restricted. Patellar and Achilles reflexes were present and bilaterally equal.

Roentgenograms made of both hips on the same plate show an impacted fracture of the right femoral neck, with callus formation and good union present (Fig. 1).

It then was learned that the roentgenogram made on the day following the injury had not been satisfactory and accurate interpretation had been impossible.

The patient was told to use crutches, as a precautionary measure, for four weeks. At the end of this period the crutches were discarded. When last seen, June 16, 1934, the patient had one-quarter of an inch of shortening, full hip motion, and excellent union, as shown by the roentgenogram. She was able to walk without a limp at the time of the last examination.

#### SUMMARY

In this case of true impaction in a fracture of the femoral neck, the patient was ambulatory, and at no time following the injury did she desist from bearing weight on the injured extremity. Union occurred during the period of active weight-bearing.

## COMPLETE DISLOCATION OF THE BASES OF THE METATARSALS, WITHOUT FRACTURE

BY PHILIP O. PELLAND, M.D., WASHINGTON, D. C.

The following case is one of lateral dislocation at the bases of the metatarsals.

Mr. A. R. H., a farmer, aged forty-five years, was admitted to the Montgomery County General Hospital on February 22, 1934, with an injury to the left foot. A horse on which he had been riding had fallen, pinning him underneath. X-ray examination showed complete lateral dislocation of the bases of the metatarsals and a fracture of the external malleolus, with slight outward displacement of the astragalus. Clinically the foot appeared swollen and discolored, when seen two days after the injury, and it was definitely widened at the tarsal-metatarsal articulations. The bases of the metatarsals could not be felt.

Treatment was instituted at this time, which consisted of insertion of Kirschner wire through the phalanges in an anteroposterior direction, application of a plaster cast with a banjo splint incorporated, and elastic traction for a period of three weeks. The dorsal aspect of the cast was removed to the ankle, in order to facilitate the traction. Two weeks after application of the traction, a slit was made in the dorsal and plantar surface of the cast in the lateral aspect, and a wide muslin bandage passed through, which was drawn tightly and anchored on the medial side. This undoubtedly aided in correcting the lateral displacement.

X-ray examination on March 15, 1934, revealed the satisfactory replacement of the bones.

The patient was up and about within eight weeks. Some swelling persisted, but he had no pain, and walked with no difficulty. Clinically, the foot appeared normal. The subsequent progress has been uneventful.

Dislocations at Lisfranc's joint are rare injuries. J. K. Narat<sup>1</sup> reported a case of his own, and in a review of the literature found that in 1904 Bayer<sup>2</sup> collected sixty-eight cases, thirty-four of which were complete and thirty-four partial dislocations; and also that a later collection (1910) by Grunert,<sup>3</sup> contained 113 cases, fifty-eight total and fifty-five partial dislocations. Stimson,<sup>4</sup> in discussing the lesion, quotes the works of several authors. Cotton<sup>5</sup> speaks of the rarity of the condition.

Stimson states: "A frequent cause has been a fall while on a horse, the pressure of the stirrup against the inner and under surface of the bone apparently causing the injury". He also states: "Reduction has always been easy by traction and direct pressure".

The injury is always produced by direct violence, and one or all of the bones may be dislocated in any direction, upward, downward, medially, or laterally, depending on the direction of the force of violence. Lateral dislocation is the type most frequently encountered, medial being the rarest.

The case here presented would seem to bear out Stimson's claims as to cause and treatment.

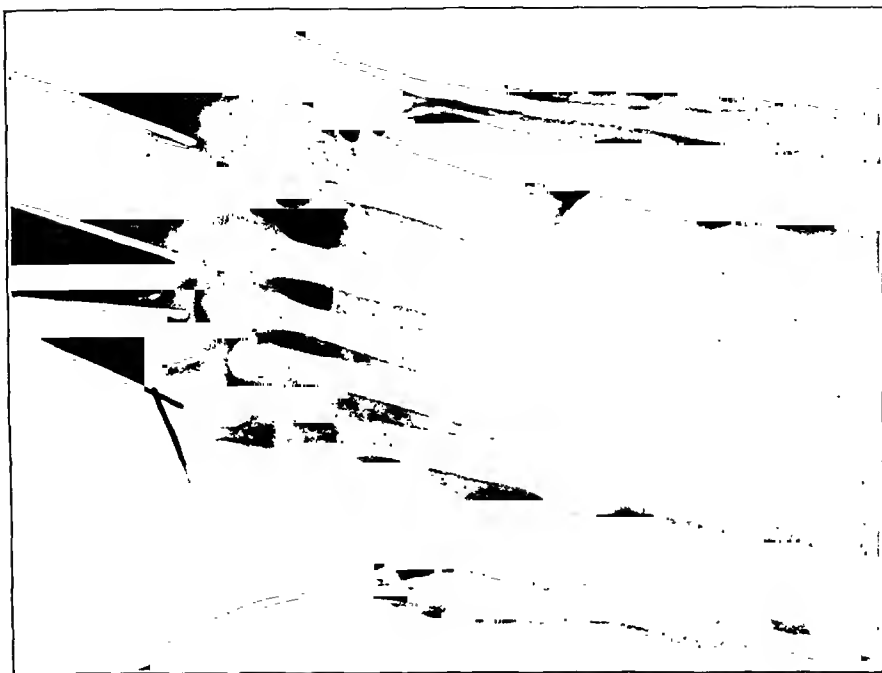


FIG. 2  
Roentgenogram taken March 15, 1934.



FIG. 1  
Roentgenogram taken February 22, 1934.



NOTE.—Dr. Frank Broschart of Gaithersburg, Maryland, who made the roentgenograms, and whom the author wishes to thank for the privilege of treating this case, states that he saw a similar case a year ago, but unfortunately the films have been lost.

## REFERENCES

1. NARAT, J. K.: An Unusual Case of Dislocation of Metatarsal Bones. *Am. J. Surg.*, N. S. VI, 239, 1929.
2. BAYER, JOSEF: Die Verrenkungen der Mittelfusssknochen im Lisfrancschen Gelenk. *Samml. Klin. Vortr.*, N. F., Nr. 372, *Chirurgie* Nr. 104, S. 65. Leipzig, 1904.
3. GRUNERT: Indirekte Frakturen des Fibulaschaftes. *Deutsche Ztschr. f. Chir.*, CV, 397, 1910.
4. STIMSON, L. A.: A Practical Treatise on Fractures and Dislocations. Ed. 8, p. 931. Philadelphia, Lea & Febiger, 1917.
5. COTTON, F. J.: Dislocations and Joint-Fractures. Ed. 2, p. 701. Philadelphia, W. B. Saunders Company, 1924.

## INFECTION IN A SIMPLE FRACTURE

BY CHARLES ROMBOLD, M.D., WICHITA, KANSAS

This case is reported because an infection complicating a simple fracture is so rare. René Villar<sup>1</sup> in 1920 described the only case reported since 1904.

An injury sustained by a boy twenty months old was mistakenly treated as a fractured clavicle. The day following the injury the patient complained of pain in the right elbow, ran some fever the second day, and on the fourth day was very restless with pain and had a temperature of 104. At this point the writer saw the patient in consultation with a pediatrician.

The right elbow was swollen, tender, painful on manipulation, and the skin was ecchymotic. The findings were typical of a fracture except for the unusual tenderness. Roentgenograms demonstrated an intracondylar fracture



FIG. 1

Four days after injury.



FIG. 2

Fifteen days after injury.



FIG. 3

Eight months after injury.

of the humerus without displacement. No explanation of the fever could be found except a few chest râles.

After two days' observation, which on retrospect was poor therapy, the arm was incised on the medial surface and drained of three to four ounces of hemorrhagic pus. The periosteum had been widely stripped from the bone throughout its circumference. Because pus exuded from the fracture line, it was thought medullary drainage was sufficient. Culture from the pus showed pneumococci.

Five weeks later drainage had ceased, the patient was using his arm well, and was free of pain. At present the healed scar marks the only variation in the two arms.

1. VILLAR, RENÉ: Un cas de suppuration d'une fracture fermée de la cuisse. J. de Méd. de Bordeaux, XCI. 541, 1920.

## A CORRECTIVE APPLIANCE FOR SCOLIOSIS

BY FRANCIS S. CHAMBERS, M.D., ELIZABETHTOWN, PENNSYLVANIA

*Chief Surgeon, State Hospital for Crippled Children*

The corrective forces exerted by this appliance (Fig. 1) are similar to those of the hinged turnbuckle jacket developed at the New York Orthopaedic Hospital.<sup>1</sup> This appliance is not intended to supplant the turnbuckle jacket, but should, nevertheless, prove of value in the treatment of scoliosis.

The parts of the brace are designated in Figure 1 by numbers which correspond to those of the specifications, as follows:

(1) A single spinal upright which is articulated at two or more points. These articulations are controlled by means of worm gears operated by a key (Fig. 2). Between the articulations the spinal upright is adjustable for changes in length, which are often required as correction progresses.

(2) A pelvic band attached to the lower end of the spinal upright. It is made of steel, covered with leather, and encircles the pelvis below the iliac crests.

(3) An ischial support attached to the pelvic band on the same side as the convexity of the

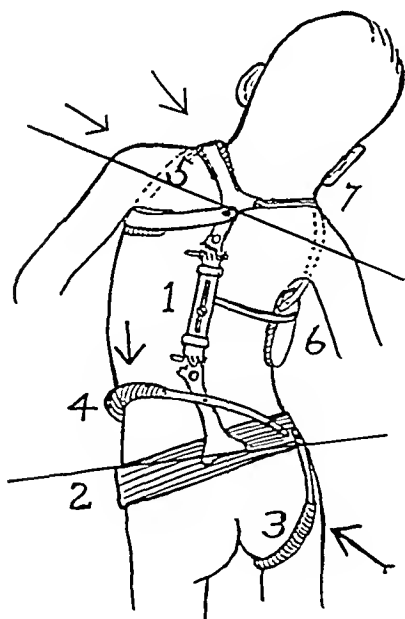


FIG. 1

The arrows indicate the direction of the corrective forces. The numbers are explained in the text. The cross lines show the level of the shoulders and the pelvis.

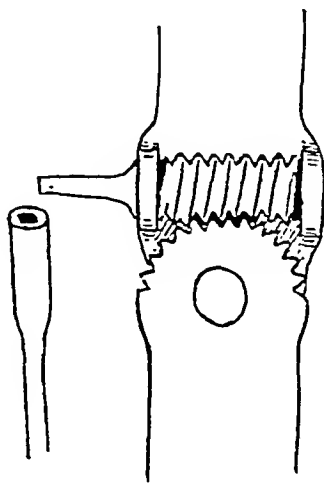


FIG. 2

Spinal upright hinge controlled by worm-gear adjustments which are operated by a key.

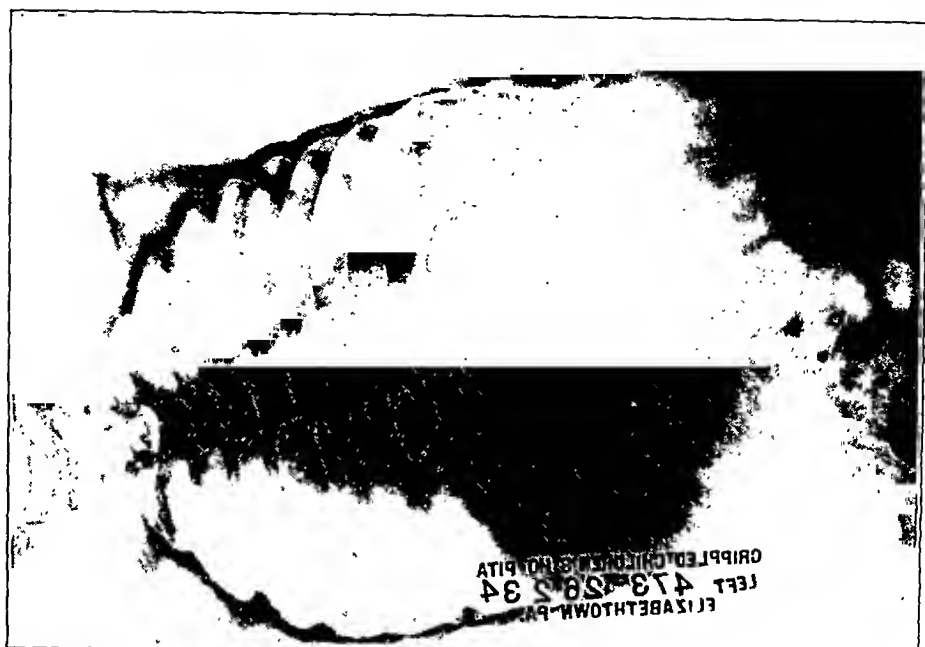


Fig. 4  
Case 2. Roentgenogram on admission.

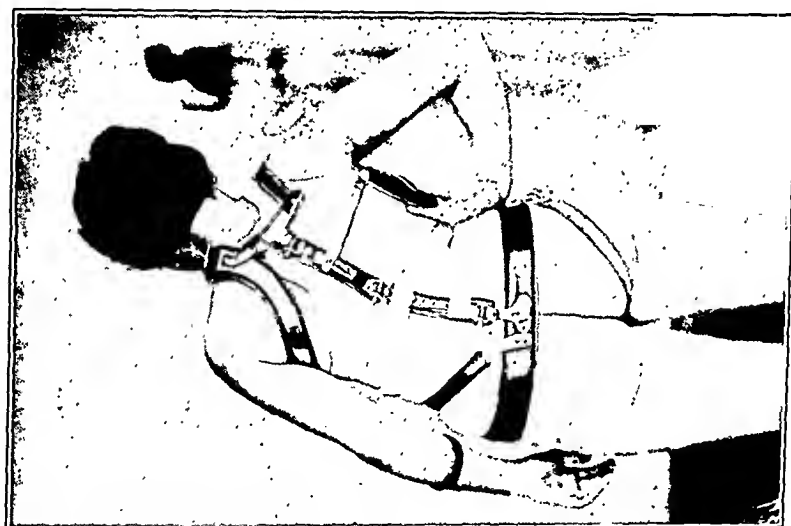


Fig. 3-B

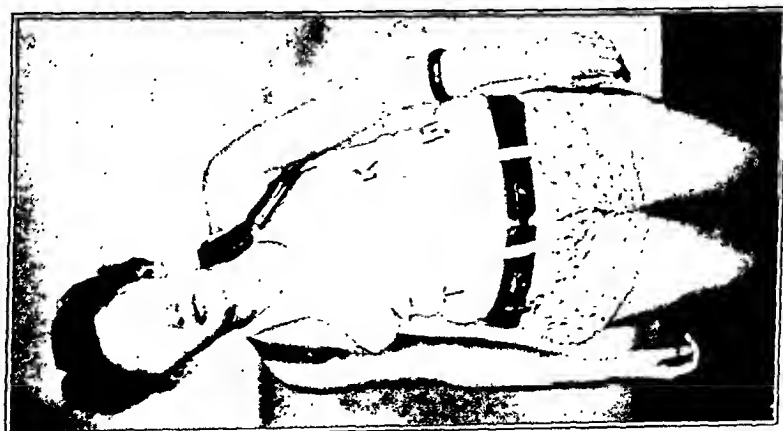


Fig. 3-A

Case 1, aged fifteen years. Showing brace equipped with three hinges. Note that the pressure pad over the ribs is exerting very little pressure.



FIG. 7

Case 2. Roentgenogram showing correction obtained by the use of the brace.

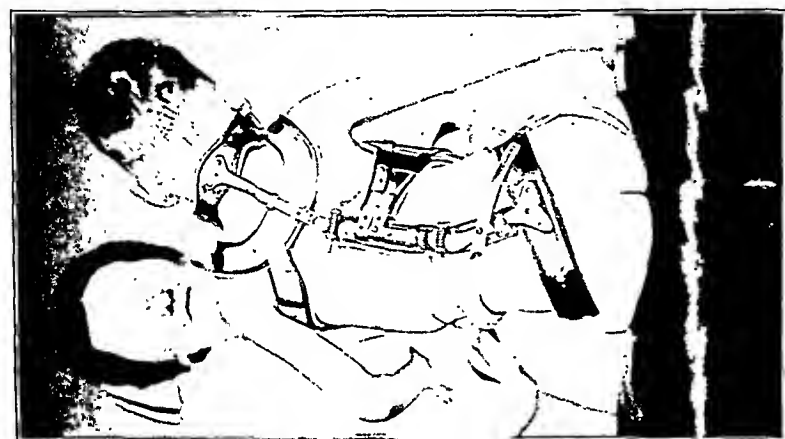


FIG. 6

Case 2, showing improvement after the application of the two-binged brace. The jury must here shown was omitted in later braces.



FIG. 5

Case 2, aged five years on admission. Puerile scoliosis due to poliomyelitis at the age of three.

spinal curvature. This support is made of steel and is well padded and covered with leather. A padded groin strap may be substituted, but this is less effective. It is advisable to make the ischial support detachable and, at the same time, to provide strap buckles so that a groin strap can

be conveniently substituted when necessary.

(4) An iliac-crest bar fitted over the iliac crest on the concave side of the curvature. It is attached to the pelvic band.

(5) A shoulder ensemble consisting of both a shoulder band and an axillary band, fitted to the shoulder on the concave side of the curvature. The shoulder band extends upward from the spinal upright over the shoulder. It must be well padded as it exerts pressure on the shoulder and the side of the base of the neck. The axillary band is attached to the shoulder band close to the spinal upright (or directly to the spinal

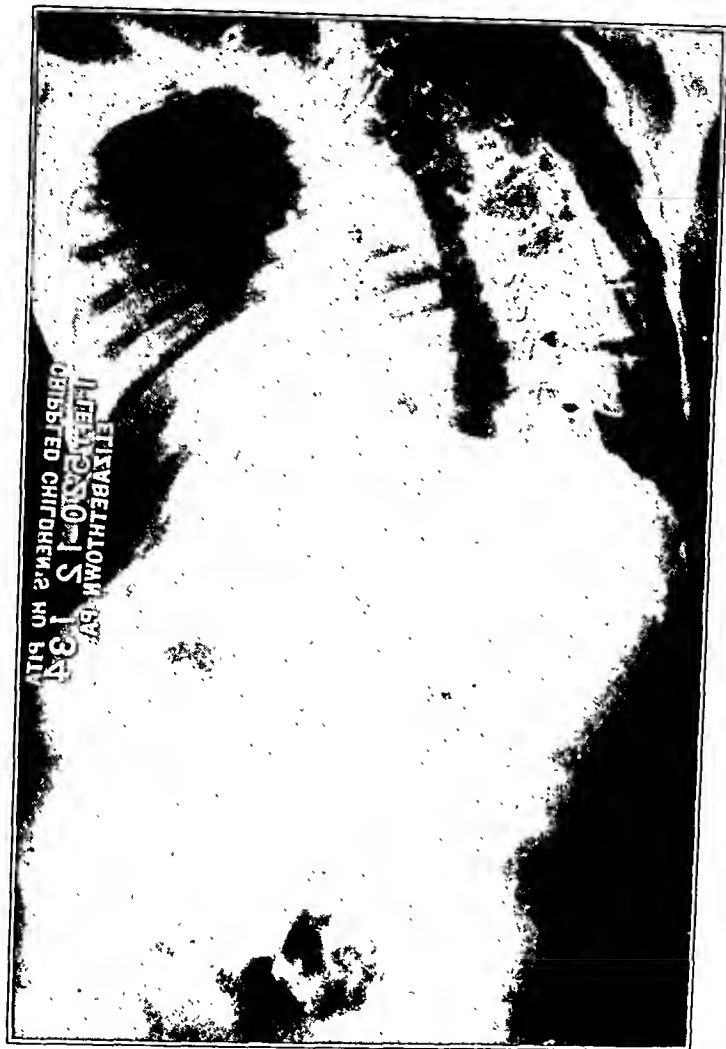


FIG. 8

Case 3. Roentgenogram on admission.

upright). It passes forward beneath the axilla and is fastened in front to the shoulder band by means of a strap and buckle. (See Figures 3-A and 3-B.)

(6) A pressure pad of sheet metal, faced with leather-covered padding and fitted over the bulging ribs on the convex side of the curvature. It is held in position by a cross bar of steel which is attached to the spinal upright. It is not designed to exert much, if any, corrective force. (See Figures 3-A and 3-B.)

(7) A shoulder strap of webbing, covered with leather and attached to the upper end of the spinal upright. It passes over and encircles the shoulder on the convex side, and is buckled to the pressure pad (6).



FIG. 11

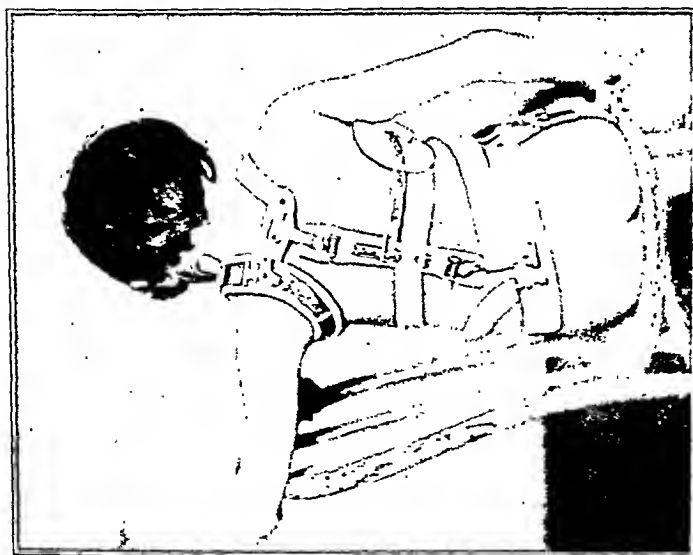


FIG. 10

FIG. 9. Case 3, aged twelve years on admission. Congenital scoliosis.

FIG. 10. Case 3. Seven months later, showing improvement in brace equipped with two hinges.

FIG. 11. Case 3. Roentgenogram showing correction in brace. Note structural changes in the vertebrae.



FIG. 9



(8) An abdominal apron of conventional design. It is provided with loops through which pass the leather flaps of the pelvic band. (See Figures 3-A and 3-B.)

The results obtained by the use of the appliance are shown in Figures 3-A, 3-B, 5, and 6.

The brace may be worn for an extended period of time, but, unless careful supervision is assured, pressure ulcerations may result. The skin areas beneath the shoulder ensemble (5) and the ischial support (3) must be watched, especially the latter.

The appliance is removed once daily to permit bathing. The correction is reduced a little before removal, and again increased when the appliance is reapplied. Children with careless nursing habits will occasionally soil the ischial support, and, for this reason, provision should be made for the convenient substitution of a groin strap.

It will be necessary to adjust the spinal uprights to maintain the shoulder ensemble (5) in proper relation, as correction progresses. It is for this reason that two or more hinges are employed. Location of these hinges is not important, as the intent is to bend the entire dorsolumbar spine by means of corrective forces gripping the pelvis below and the shoulder and base of the neck above.

1. HIBBS, RUSSELL A., RISSER, JOSEPH C., AND FERGUSON, ALBERT B.: Scoliosis Treated by the Fusion Operation. An End-Result Study of Three Hundred and Sixty Cases. *J. Bone and Joint Surg.*, XIII, 91, Jan. 1931.

## A SIMPLE CLAMP FOR REDUCING FRACTURES OF THE CALCANEUM AND TIBIAL TUBEROSITIES

BY R. M. YERGASON, M.D., F.A.C.S., HARTFORD, CONNECTICUT

Comminuted fractures of the os calcis frequently produce a mushrooming of the fragments, thereby increasing the transverse diameter of the bone. Sometimes the tendo achillis pulls up a large fragment. In either case the reduction of the fracture requires compression of the bone in order to lessen the increased diameter.

Again, in fractures of the tibial tuberosities (the so called "bumper fractures"), there is often displacement with increased diameter, requiring forcible local pressure for reduction.

Occasionally we have found it most convenient to place a heavy felt over the displaced fragment and pound it into place with a mallet. By this method, however, it is hard to tell just how much is being accomplished by each blow; whereas a large clamp gives the needed power, and enables us to proceed slowly in palpating the bone, often feeling the fragments move into place.

Böhler<sup>1</sup> has advocated the use of a specially designed clamp, called a "*redressor*", which is of metal with two rounded knobs to bear against the os calcis.

A carpenter's clamp, of the type illustrated, is easily adapted to the special needs of any fracture requiring compression. A hole, three-sixteenths of an inch in diameter, is bored through each of the jaws and an iron rod, bent L-shape to furnish a handle, is inserted. Blocks of soft cedar, with holes to fit on the rods, are whittled out to serve as bearing knobs. They can be carved in any form the operator may desire; in use, they turn upon the rods, thereby making adjustment easier.



FIG. 1

Clamp applied to compress the calcaneum.

Figure 1 shows the clamp arranged on a heel for dorsoventral pressure. There are bandages about the foot and ankle, which pass through convenient holes bored in the clamp jaws to prevent the clamp backing off when pressure is applied. The posterior, or upper, block is hollowed out to span the heel cord, so that its pressure is exerted more directly upon the bone and less upon the tendo achillis.

In fractures of the tibial tuberosities, it is the author's custom to apply a strong plaster cast the day before reduction, so that it will be quite hard when the clamp is used. A fenestrum is cut opposite the tuberosity to be reduced, heavy felt is placed over the bone, and the clamp is applied with one jaw on the felt and the other bearing on the opposite side of the cast. As the metal screws of the clamp pivot somewhat in the jaws, another form of adjustment is furnished, which is particularly convenient when used for fractures of the upper tibia.



FIG. 2

Showing that the clamp allows one jaw to be projected beyond the other, and pressure blocks of various shapes.

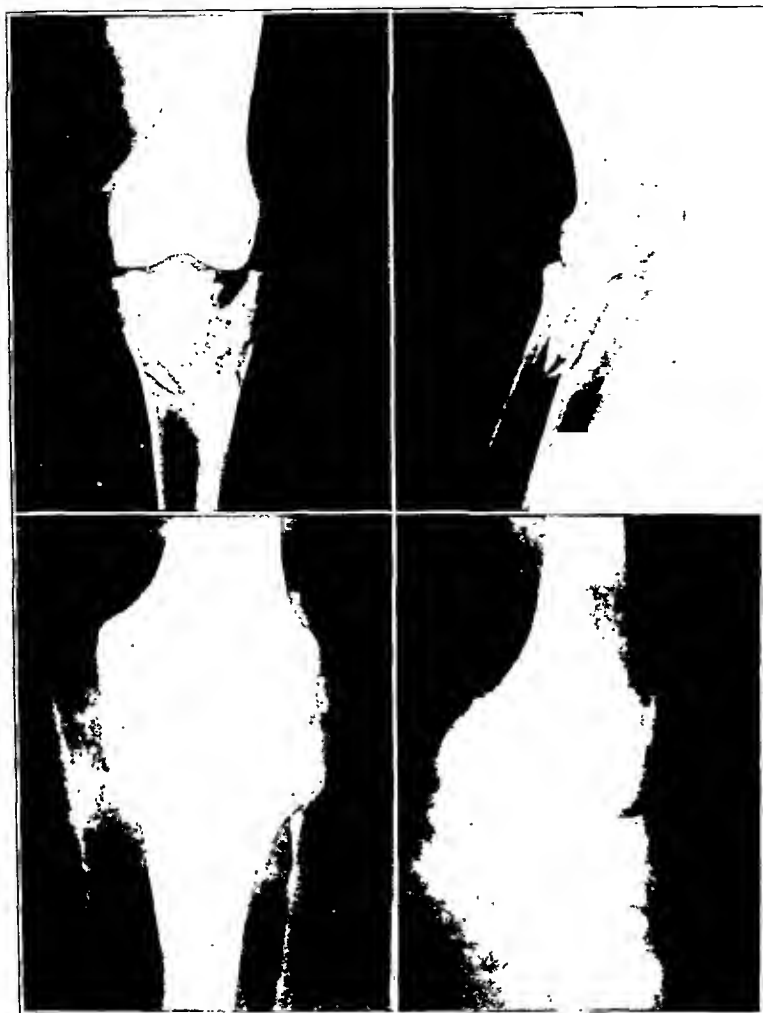


FIG. 3

In this fracture of both tuberosities the clamp was applied in a somewhat oblique anteroposterior position to bring *up* the inner tuberosity (seen best in lateral views) and in a transverse direction to bring *in* the external tuberosity.

The author has used this type of clamp in reducing fractures for the past fifteen years with great satisfaction in the results obtained.

1. BÖHLER, LORENZ: *The Treatment of Fractures*. Vienna, Wilhelm Maudrich, 179, 1929.

## A NEW TYPE OF FRACTURE BAND

BY F. WALTER CARRUTHERS, M.D., F.A.C.S., LITTLE ROCK, ARKANSAS

The use of the various bands, screws, nails, and plates for holding fractures in proper position presents numerous disadvantages. For this reason, a new band has been perfected.\* This band is made from kangaroo tendon; by a certain manufacturing process, it has been made adequate to overcome many of the drawbacks of the various other materials.

At the suggestion of the writer, the middle portion of the usual rounded kangaroo suture has been flattened out, making the center portion ribbon-like in appearance. This gives the needed surface contact for support when the band is applied about a fracture. Each end of the tendon is left rounded, so that the ends may be easily tied together or one end may be placed through a drill hole in the bone as described below. The illustration (Fig. 1) shows the finished product. The tendon has been made in different sizes so that it may be used on bones of different diameters. The ribboned areas are made 5.5, 6.5, and 7.5 inches in length. Each of the rounded ends is approximately the length of the flattened section. Therefore, it may be readily seen that the flat portion of the band gives a wider area of contact about the fracture, and naturally will grip around the bone more securely and with less likelihood of slipping than the conventional rounded suture materials used heretofore.



FIG. 1

### TECHNIQUE OF APPLICATION

The technique of the application of the new type of fracture band is very simple. After the reduction of the fracture has been accomplished, the band may be applied in one of two ways. It may be spiraled around the bone in a figure-of-eight manner and the tapering ends tied securely together or, in some of the longer types of oblique fractures, a hole may be drilled through the upper fragment, then one end of the band is passed through another drill hole in the lower fragment and fastened as in the

\* By Davis & Geck, Inc.

upper one. Both of these techniques are shown in Figures 2 and 3.

To apply the band spirally around the bone, one end of the band is tied through the drill hole in the upper fragment, and the other end is passed through a hole in the end of a bone hook. The hook is slipped around the bone and the end easily slipped out and rethreaded, so to speak, and passed again and again about the bone as often as necessary. The number of times it is spiraled around the bone depends upon the length of the fracture. It is finally tied through a drill hole in the lower fragment.

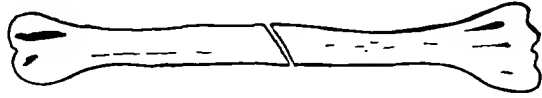


FIG. 2



FIG. 3

#### OBSERVATIONS

The writer has found the use of the band a distinct advantage. It does not prevent union and does not



FIG. 4

disturb the blood supply at the site of the fracture by its pressure; and it is entirely absorbed without complications.

The band has been used by the author in one animal experiment, fourteen cases of fractures of various bones, and five cases of hernia (one abdominal and four inguinal).

The operation on the dog which was purely experimental showed nothing unusual. An oblique fracture was produced through the middle of the femur by means of a chisel. The band was used to secure maintenance of reduction with figure-of-eight application. Primary union of the wound occurred, with good union at the site of the fracture and with no drainage or postoperative complications. At the end of four weeks the wound was reopened and explored. Union was complete and the band had almost completely absorbed.

The fourteen cases in private practice were as follows: six oblique fractures of the tibia, one oblique fracture of the femur, three oblique fractures of the ulna, three transverse fractures of the radius, one oblique fracture of the humerus, and one very long oblique fracture of the left clavicle. Two of the fractures of the tibia were compound and comminuted; one fracture of the radius and one of the ulna were compound. In another case of fracture of the tibia the fracture was compound and comminuted and osteomyelitis developed. The band was not a factor in the development of infection and the case is not included in this report. In all of the cases the results of treatment were satisfactory and there were no complications.

## THE MATED BRADFORD FRAME

BY ALFRED J. BUKA, M.D., PITTSBURGH, PENNSYLVANIA

The mated Bradford frame suggests an efficient method for treating spinal conditions, such as Pott's disease and the numerous other problems which require recumbency at all times, with or without traction. Whether or not this is a new method, the author is unable to state, but he has not seen it in use before.

The accompanying photographs illustrate the procedure. The patient suffers from a typical tuberculosis of the spine, involving the seventh, eighth, and ninth thoracic vertebrae.

This procedure calls for the use of two Bradford gas-pipe frames made exactly alike so far as the location of the bend and the degree of the arc are concerned. The coverings and bed clothing are placed in like manner upon the two frames, but on opposite curved surfaces. Sectioning for the dressings on the concave frame is not done, since the patient is permitted to rest ventrally upon this frame for active treatments and other considerations to the dorsum of the body. The concave frame maintains the position of the spine which is established on the convex mate upon which the patient spends most of his time. An important feature in this procedure is the fact that the spine remains in a fixed position at all times; at least, there is very little disturbance to the involved area. At the outset the two frames are of equal length. After a time, however, a growing patient may find the convex frame too short for dorsal recumbency, but the frame for ventral recumbency may be satisfactorily utilized for a longer time, since the patient is very comfortable upon his abdomen even though his head and feet extend somewhat beyond the ends of the frame.

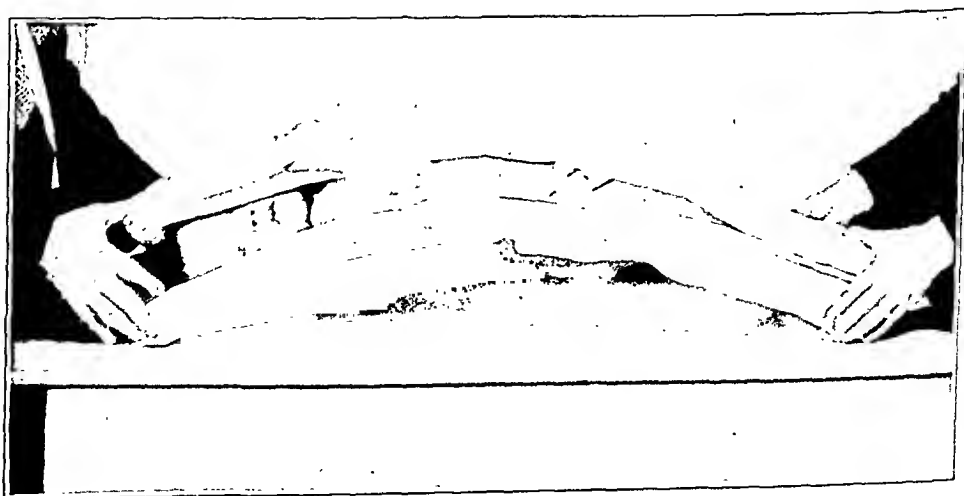


FIG. 1

Patient resting dorsally on convex Bradford frame. The concave frame is in position for changing the patient.

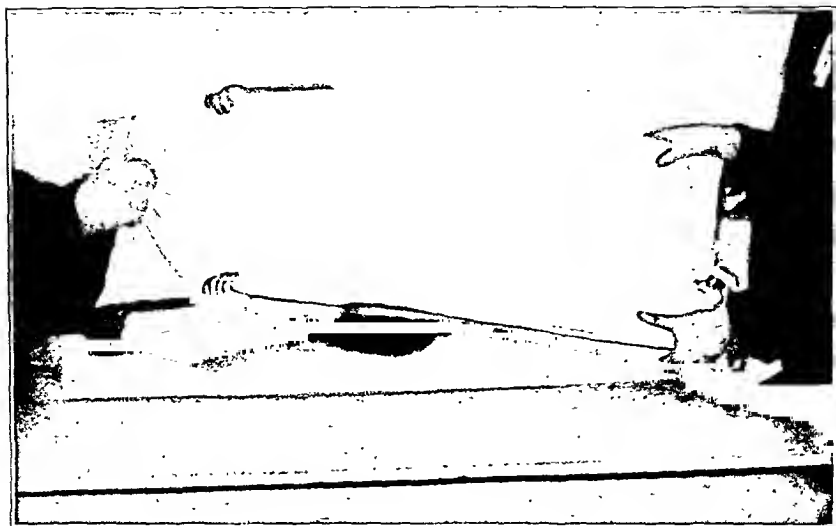


FIG. 2

Patient in dorsal position between mated Bradford frames in process of being turned. (A turn of 90 degrees is made; note the assistance of the patient.)

This method is particularly advantageous in treating lesions of the spine in the young. They enjoy participating in making the change and it affords them a desired new position. On the concave frame there is offered considerable freedom of the extremities during the period of ventral recumbency, which is a desirable feature. A considerable amount of cooperation is given even by the young child when he is being changed from one frame to the other.

Adults treated by this method are as readily changed from the convex to the concave frame. However, in order to lessen the possibility of

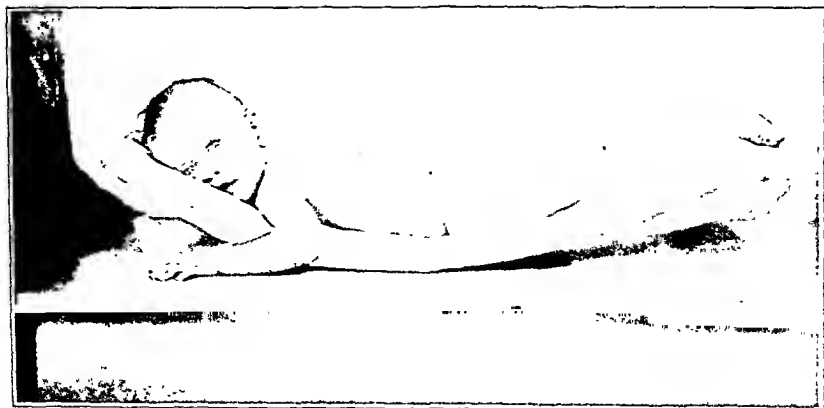


FIG. 3

Patient resting ventrally on concave Bradford frame.



disturbance of position, several wide ties (head, foot, and center) may be placed about both frames and the patient before turning. The change is more easily effected if made across the bed, thereby removing many difficulties and fears from those concerned.

There may be some objection raised because of the fact that this method requires two persons in making the change from one frame to the other. However, the following advantages offered by the mated Bradford frame should win for it favor over the present method of application of the Bradford frame: (1) a better opportunity for consideration of the patient's back; (2) greater ease and rapidity in changing covers and clothing; and (3) a satisfactorily long period of change in position during recumbency. It is felt that the use of a mated Bradford frame is an inexpensive adjunct for treatment of the spinal column and its adoption in institutions and in the home should prove of benefit.

# A METHOD OF STRAPPING THE CHEST FOR FRACTURE OF THE RIBS

BY ROLAND HAMMOND, M.D., PROVIDENCE, RHODE ISLAND

The conventional method of treatment for fracture of one or more ribs is to strap slightly more than one-half of the chest, so that the adhesive plaster begins and ends on the sound side. This is done while the thorax is in full expiration and results in a constriction of breathing, which is very objectionable to some patients. It has the further disadvantage of limiting motion in one-half of the chest as a whole, while the fractured rib itself is not accurately splinted.

The following procedure has been evolved after comparative tests of the two methods. Physicians who have consulted the writer for fracture of a rib have invariably stated that strapping the rib was more comfortable than strapping the chest.

The strapping is applied in the line of the rib, beginning on the abdomen, and is carried upward to the base of the neck, under considerable tension, to approximate the fragments (Fig. 1). The method is not universally applicable to all cases of fracture of ribs, particularly when multiple, but may be used for the more common and simpler injuries.

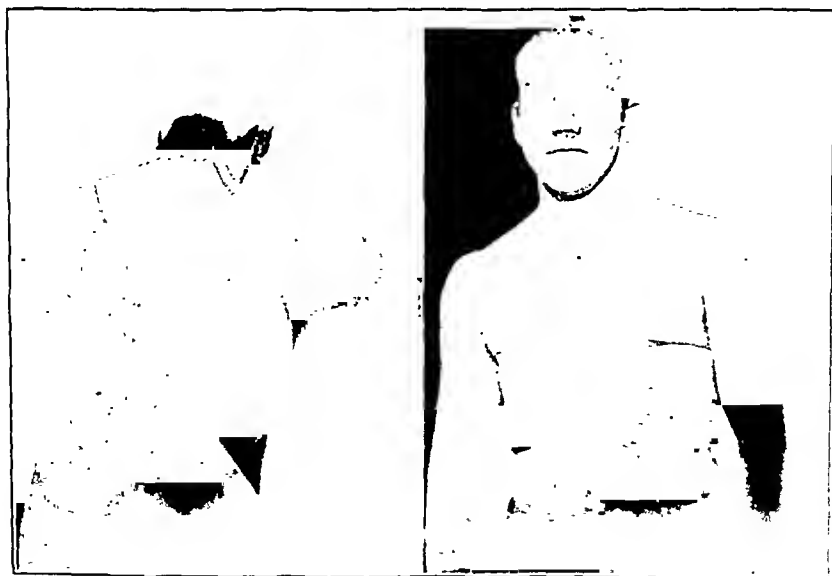


FIG. 1

Method of strapping fracture of the ribs.

FIG. 2

Belt used for cases of fracture of the ribs where there is excessive growth of hair.

In individuals with an excessive growth of hair, strapping of the chest is a very uncomfortable method of treatment. For such cases a belt has been devised, made of six-inch webbing, reenforced with corset steels to preserve the shape of the belt, and buckled in front. It should be accurately shaped to the chest by removing a gore at the back and fitting the two sides separately. When fitted in this way, it will remain in position without slipping (Fig. 2).

# A SUGGESTION FOR A MORE ACCURATE LOCALIZATION OF THE SACRO-ILLAC JOINT

BY MOSES GELLMAN, M.D., BALTIMORE, MARYLAND

During the performance of an arthrodesis of the sacro-iliac joint after the method of Smith-Petersen, it is true that certain anatomical landmarks are followed for the purpose of projecting this joint upon the exposed lateral surface of the ilium.

A more precise delineation of this joint for each individual case is desirable, if the exact confines of the concealed, underlying sacrum can be determined in relation to the concealing, overlying ilium.

Recently, while performing this operation, it was found that simply by percussing the ilium over the general region of the sacrum with the handle of an osteotome, it was possible to find an area of definite dullness which accurately defined the superior, inferior, posterior, and anterior borders of the sacro-iliac joint.

The removal of a "watermelon-plug" or window one-eighth to one-fourth of an inch within the borders of this area of dullness exposed practically the entire surface of the joint.

This method has since been tested on the pelvis of several skeletons, on both sides of a cadaver, and in another operative case, and has been found to be quite satisfactory.

It is now suggested as a more accurate procedure for localizing the sacro-iliac joint at operation.

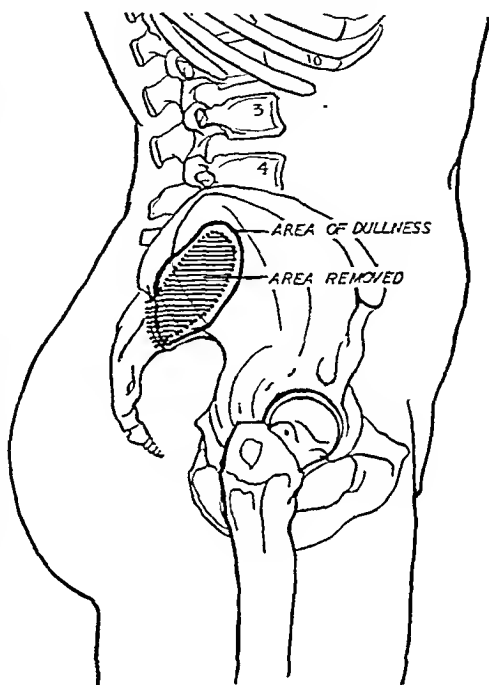


FIG. 1

# News Notes

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It is with regret that we have to announce the sudden death of Dr. Lewis Stephen Pilcher on December 24 at the age of eighty-nine. Dr. Pilcher is known throughout the medical world as the Editor of *Annals of Surgery*, a position which he has filled with much distinction since 1884. The development and conduct of this journal was only one of the important activities in which Dr. Pilcher was engaged throughout his life. The profession will realize the loss which it has sustained.

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Dr. Benjamin P. Farrell has moved his office to Suite 1908, 654 Madison Avenue, New York.

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Dr. Albert H. Freiberg and Dr. Joseph A. Freiberg have announced the association with them in the practice of orthopaedic surgery of Dr. Theodore H. Vinke. Their address is 707 Race Street, Cincinnati, Ohio.

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At the **Hospital for Joint Diseases** on Thursday evening, December 6, the fifth Sir Robert Jones Lecture was given by Dr. Philip D. Wilson, Surgical Director of the Hospital for Ruptured and Crippled. Dr. Wilson's subject was "What Can Orthopaedic Surgery Do for the Arthritic Cripple?"

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The **Orthopaedic Forum** held its Fifth Annual Meeting in Philadelphia from November 30 to December 2, its complete membership being in attendance. A very interesting program was offered, including the presentation of papers and the holding of clinics in the Graduate, Shriners', Pennsylvania General, and Temple University Hospitals. It was decided to hold the 1935 meeting in Atlanta, Georgia.

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The Sixteenth Annual Meeting of the **Congrès Orthopédique Français** was held on October 12, 13, and 14 at the Faculté de Médecine in Paris. The principal subjects of discussion were:

"Surgical Treatment of Funnel Chest", presented by Dr. Garnier of Paris.

"The Orthopaedic Treatment of the Spasmodic Paralyses", presented by Dr. Delchef of Brussels and Dr. Roudil of Marseilles.

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The Annual Meeting of the **Clinical Orthopedic Society** was held in St. Louis on November 9 and 10. Interesting clinical demonstrations were given by the local members of the Society. The following officers were elected for the coming year:

President: Dr. E. S. Hatch, New Orleans, Louisiana.

Vice-President: Dr. Phil Hoffman, St. Louis, Missouri.

Secretary-Treasurer: Dr. J. E. M. Thomson, Lincoln, Nebraska.

The meeting for 1935 is to be held in Indianapolis, Indiana and Louisville, Kentucky.

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The **Pacific Northwest Orthopaedic Society** held its Annual Clinics and Meeting at Seattle, Washington on September 22, 1934. The morning was devoted to clinics held at the Children's Orthopaedic Hospital and the afternoon session, which included a dry clinic and demonstrations, was held at the King County Hospital. At the business meeting held in the evening it was voted to change the name of the Society to the "North Pacific Orthopaedic Society".

Officers chosen for the coming year are:

President: Dr. Richard Dillehunt, Portland, Oregon.

Vice-President: Dr. H. C. Blair, Portland, Oregon.

Secretary-Treasurer: Dr. Leo Lucas, Portland, Oregon.

The next meeting is to be held in Portland, Oregon.

relieved by hyperextension of the spine. Laminectomy was only indicated in cases exhibiting the spinal-tumor syndrome (the neurological signs preceding the orthopaedic sign), or in cases of posterior spinal disease. Cases of late-onset paraplegia should be treated conservatively, but in severe cases the removal of tuberculous material, or of bony ridges, and combined laminectomy and spinal grafting should be considered. If there was complete motor paralysis for more than six months, there was no likelihood of recovery.

#### THE TRANSPORTATION OF CASES WITH BACK INJURIES

Mr. T. P. McMurray, Liverpool, said that in fractures of the spine the advantage of face-down transportation was that the postural movement necessary to reduce the fracture was instituted at once, so that the risk of injury to the spinal cord was minimized. The disadvantages were that such patients suffered from shock, and that lying on the face might embarrass respiration; there might be fractures of several ribs with danger of visceral injury.

#### CONGENITAL CLUB-FOOT

Miss Forrester-Brown, Bath, advocated repeated manipulation, splints, and plaster as the routine treatment of congenital club-foot, but said that there was relapse in many cases despite every care and attention. Open division of the tight structures on the inner side and at the back of the heel was often necessary, and in old cases an astragalectomy was sometimes performed. A rotation osteotomy of the tibia was a valuable procedure for persistent intoeing.

#### FRACTURES OF THE NECK OF THE FEMUR AND INTRA-ARTICULAR ARTHRODESIS OF THE HIP

Mr. R. Watson Jones, Liverpool, said that, after high fracture of the neck of the femur, there was often roentgenographic evidence of impairment of blood supply in the proximal fragment, and this accounted for the slow union of these fractures. Nevertheless, the neck distal to the fracture had a normal blood supply, and its decalcification and absorption were due to the traumatic hyperaemia of continued movement of the fragments on each other; it was not observed when the fracture was perfectly immobilized. The prolonged and complete immobilization necessary could be secured by the Smith-Petersen nail, but the operation was most difficult. The speaker had devised a canalized nail and guide to facilitate accurate central insertion by open operation. A similar principle had been independently used by West in Australia and Sven Johansson in Sweden, but these workers had developed a subcutaneous technique with Kirschner wire and roentgenographic control, which was more difficult and less certain. The treatment was relatively safe, even in very old people, because no splints or plaster were used; no weight-bearing was permitted until the fracture was united. The operation was contra-indicated in old fractures with avascularity of the head of the femur. Non-union after arthrodesis of the osteo-arthritic hip was analogous to non-union after fracture of the neck of the femur and could be prevented in the same way by driving a Smith-Petersen nail into the pelvis. With this addition to the technique of simple intra-articular arthrodesis, consolidation was certain and rapid.

#### MOVEMENT OF THE LUMBAR SPINE IN PREGNANCY

Mr. C. Lambrinudi, London, reported clinical observations which disproved current obstetrical teaching that lumbar lordosis was normal in pregnancy. Normally, there was extension of the lumbar spine and flattening of the sacrum, but this movement was only possible if the muscular tone was good and the sacro-iliac and lumbosacral joints were mobile. Failure in this mechanism, with the development of an abnormal lumbar lordosis, accounted for backache during and after pregnancy.

Mr. N. Capener, London, showed a series of comparative roentgenograms of the lumbar spine with patients lying, standing, and stooping. The intervertebral foramina

Miss J. T. W. Bucknell, Ethel Hedley Hospital, Calgarth Park, Windermere.  
 R. J. Furlong, St. Thomas's Hospital, London, S. E. 1.  
 J. M. Gibson, St. Nicholas' and St. Martin's Orthopaedic Hospital, Pyrford, Surrey.  
 C. H. Gray, Breeze Mount, Wilderswood, Horwich, Bolton.  
 Miss M. F. Johnstone, 121 North Road, Clayton, Manchester.  
 W. L. MacDonald, Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry.  
 A. M. MacGill, 334 Wellington Road North, Heaton Chapel, Manchester.  
 A. B. Pain, The General Infirmary, Leeds.  
 J. C. Scott, Wingfield Morris Hospital, Headington, Oxford.

At the Executive Committee Meeting held in November, the following were elected Associate Members:

I. D. Kitchin, Orthopaedic Hospital, Hartshill, Stoke-on-Trent.  
 N. W. Roberts, Grasscroft, Archway Road, HUYTON, Liverpool.

At the meeting of the Executive Committee in November, the following were elected Honorary Members:

John Fraser, 32 Murray Place, Edinburgh, Scotland.  
 G. M. Huggins, Clarendon House, Baker Avenue, Salisbury, Rhodesia, South Africa.  
 W. Noordenbos, Emmapplein 10, Amsterdam 2, Holland.  
 J. Schoemaker, Zuidwal Hospital, The Hague, Holland.  
 D. P. D. Wilkie, 9 Ainslie Place, Edinburgh, Scotland.

The Annual Meeting of the **British Orthopaedic Association** was held in London on Friday and Saturday, November 2 and 3. Clinical programs were arranged at St. Bartholomew's Hospital by Mr. R. C. Elmslie and his colleagues, and at the Lambeth Hospital by Mr. Stebbing. The Robert Jones Gold Medals were presented to Mr. R. W. Butler and Mr. H. J. Seddon, whose essays on the subject of Pott's Paraplegia were read in opening the first discussion.

#### POTT'S PARAPLEGIA

Mr. R. W. Butler, Cambridge, said that in tuberculous disease of the spine three clinical types of paraplegia should be differentiated. The first type, "early-onset, temporary paraplegia", was due to toxic and vascular reactions in the cord from the activity of tuberculous disease, and sometimes to compression of the cord by caseous granulation tissue. In the second type, "early-onset, permanent paraplegia", the paralysis persisted after recovery of the tuberculous disease, owing to avascular atrophy of the cord; it was attributable to prolonged compression of the cord by abscesses, to acute thrombosis of the vessels supplying the cord, to bony compression by pathological dislocation of the spine, or to compression by the displacement of sequestra. In the third type, "late-onset paraplegia", the paralysis might appear many years after apparent quiescence of the disease, and this type included fifty per cent. of the whole series of 193 cases. Late paraplegia was due to atrophy of a previously damaged cord as a result of prolonged or of fresh infection; bony compression was a rare cause and there was no evidence that chronic tuberculous meningitis was responsible for paraplegia at any stage.

Mr. H. J. Seddon, London, said that for every four cases of early-onset paraplegia which recovered, there was one which failed to recover. Failure was due either to persistence of cord compression for too long a period, or to the sudden complications of vascular thrombosis or bony compression by dislocation. Treatment, therefore, was primarily conservative and included immobilization and hyperextension. If some voluntary power remained, the prognosis was excellent; but, if there was complete loss of voluntary power, recovery was unlikely unless pressure was relieved during the first six months. If there was not spontaneous recovery within six months of onset, costotransversectomy and evacuation of the abscess was indicated. When the onset of paraplegia was sudden and paralysis was complete within a few days, bony compression should be suspected and

relieved by hyperextension of the spine. Laminectomy was only indicated in cases exhibiting the spinal-tumor syndrome (the neurological signs preceding the orthopaedic sign), or in cases of posterior spinal disease. Cases of late-onset paraplegia should be treated conservatively, but in severe cases the removal of tuberculous material, or of bony ridges, and combined laminectomy and spinal grafting should be considered. If there was complete motor paralysis for more than six months, there was no likelihood of recovery.

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were enlarged in flexion of the spine and narrowed in hyperextension. The bearing of this observation on sciatic scoliosis was discussed.

#### ADOLESCENT COXA VARA

Mr. V. H. Ellis, London, reported nine cases of slipped upper femoral epiphysis and advocated gradual correction of the deformity by skeletal traction in a Thomas splint. Foreible correction by manipulation under anaesthesia usually caused degeneration of the epiphysis and osteo-arthritis of the hip.

The Spring Meeting of the Association is to be held in April at Berck-sur-Mer, and the next Annual Meeting in October at Manchester.

### THE AMERICAN BOARD OF ORTHOPAEDIC SURGERY, INC.

NOTE: At the request of Dr. Melvin S. Henderson, President of the American Board of Orthopaedic Surgery, Inc., the following statement from this new board is published.—  
*Editor:*

#### GENERAL INFORMATION

The growth of specialism in the field of medicine has been accompanied by an insidious trend toward lower standards of qualification and a distortion of the true significance of the term "Specialist". Men with inadequate training and experience assume the title of "Specialist" and by so doing degrade others who may be unusually well equipped to practise in a restricted field of medicine.

The regulation of standards of preparation and of special practice must come either from the State or from the specialty itself. State supervision and regulation is being considered. This will mean control by the many state licensing boards, with the inevitable introduction of political standards. The establishment and maintenance of scientific standards by the specialty is to be preferred. Several of the specialties have organized examining boards which are now functioning. Ophthalmology formed its board of certification in 1916. Subsequently similar boards have been formed by otolaryngology, obstetrics, gynecology, dermatology, pediatrics, radiology, and other special groups. The boards have met with favorable experience both on behalf of the specialty and the specialist.

The Association of Examining Boards has been formed to correlate the activities of the national boards of the various specialties.

The formation of The American Board of Orthopaedic Surgery was initiated by The American Orthopaedic Association. A committee has made favorable reports at the Annual Meetings of the Association for the past three years. Similar consideration has been given this subject by a special committee of the Section on Orthopedic Surgery of the American Medical Association. The American Academy of Orthopaedic Surgeons approved this course and added their support during the past year.

The American Board of Orthopaedic Surgery was formed by the joint action of The American Orthopaedic Association, The Section on Orthopedic Surgery of the American Medical Association, and the American Academy of Orthopaedic Surgeons. Three delegates were officially appointed by each body.

The American Board of Orthopaedic Surgery was incorporated under the laws of Delaware in 1934.

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#### EXCERPTS FROM BY-LAWS

Article 1. Section 1. *Definition.* Orthopaedic surgery is that branch of surgery especially concerned with the preservation and restoration of the functions of the skeletal system, its articulations and associated structures.

Article 2. Section 2. *Purposes.* To test and determine the qualifications of applicants for registration and to issue certificates to those found qualified.

Section 3. To prepare and maintain a registry of the holders of the certificates issued by the Board.

Section 4. To serve the public, physicians, hospitals, and medical schools by furnishing lists of those who have received the certificate of the Board and thus assist in protecting the public against irresponsible and unqualified practitioners who profess to specialize in orthopaedic surgery.

Article 7. Section 1. *Application for Certificate.* Each application for a certificate shall be filed with the Secretary upon the prescribed form, and shall be accompanied by the fee which the Board may fix from time to time. It shall also be accompanied by an unmounted autographed recent photograph of the applicant and the names of two orthopaedic surgeons acceptable to the Board, who may be referred to for information in regard to the applicant.

Section 2. The applicant must have the following qualifications:

- (a) He must be of high ethical and professional standing.
- (b) He must be duly authorized to practise medicine in the state or province of his residence.
- (c) He must be a member of the American Medical Association or the corresponding medical association of the country in which he lives.
- (d) He must have had one year of internship in a general hospital acceptable to the Board.
- (e) He must have had two years of concentrated instruction in orthopaedic surgery approved by and acceptable to the Board.
- (f) He must have had two years of further experience in the actual practice of orthopaedic surgery or such equivalent as may be satisfactory to the Board.

Section 3. Each applicant shall be examined and his qualifications determined by the Board in such manner as it may designate, and his record shall be reviewed by the Board in the light of all assembled information, and, in its discretion, the Board may waive any of the qualifications set forth in Section 2 of this article when, in its opinion, the applicant is otherwise qualified.

Article 8. Section 1. *Certificate.* If the applicant is found qualified therefor, a certificate that he has been found by this Board qualified to practise orthopaedic surgery shall be issued to him. The certificate shall be in such form as may be adopted by the Board, shall be signed by the President, or in his absence by the Vice-President, and the Secretary and sealed with the corporate seal.

#### Purpose of Fee

The fee of \$25.00 sent to the Board at the time of application is intended to cover the expenses of the Board. All Board members are serving without compensation. Should the applicant be unable to meet the requirements of the Board for certification after three appearances before this Board, fifty per cent. of the fee will be returned to him.

#### CERTIFICATE OF BOARD NOT A LICENSE

The aim of the Board is to elevate the standard of qualifications for orthopaedic surgeons and to certify those who voluntarily comply with the requirements of the Board. The certificate carries no legal qualifications, privileges, or license. The Board does not intend to limit or interfere with the professional activities of any duly licensed physician.

#### ADVANTAGES

1. Certification by the Board furnishes a criterion to both lay and professional groups for judging an orthopaedic surgeon's qualifications.
2. Hospitals and other organizations will gradually establish rules limiting service on their staffs to those certified by the Board.
3. Such certification will gradually tend to limit specialization to those best qualified.

4. Eligibility to special societies will be based on the Board's certificate.
5. The profession and laity will be guided in choosing their consultants and specialists.

#### MEMBERS OF THE BOARD

President: Melvin S. Henderson, M.D., Rochester, Minnesota.

Vice-President: Edwin W. Ryerson, M.D., Chicago, Illinois.

Treasurer: Henry W. Meyerding, M.D., Rochester, Minnesota.

Secretary: Fremont A. Chandler, 180 North Michigan Ave., Chicago, Illinois.

Samuel Kleinberg, M.D., New York, N. Y.

Philip Lewin, M.D., Chicago, Illinois.

W. Barnett Owen, M.D., Louisville, Kentucky.

John C. Wilson, M.D., Los Angeles, California.

Hulett J. Wyckoff, M.D., Seattle, Washington.

## Current Literature

OSTEOMYELITIS: ITS PATHOGENESIS, SYMPTOMATOLOGY, AND TREATMENT. By Abraham O. Wilensky, A.B., M.D., F.A.C.S. New York, The Macmillan Company, 1934. \$9.00.

The Macmillan Company have just published Abraham O. Wilensky's scholarly treatise on osteomyelitis, a 450-page volume, well indexed and documented. The first thirty pages of historical perspective, which precedes the formal discussion of the disease, cites the information that paleopathologists have brought to light concerning the diseases of bone, dating back 5000 years and more. Then follows an anatomical résumé of the development of normal bone, a knowledge of the internal architecture of which permits a better understanding of the behavior of those bacterial agencies that are concerned in the pathology of osteomyelitis.

The way in which the bone marrow becomes infected through the blood stream as a carrier of infected thrombi, which become checked by accidents in the local osseous circulation, is pointed out in the chapter on Pathology. From the points where the bacteria become arrested in their progress, thromboses spread along the vascular channels and necrosis of the bone cells results. The primary location and the spread of infection are determined by the particular part of the vascular system in the bone involved which has been the site of the invasion. Abscess formation and sequestration then ensue, the details of which processes are fully described for the various types of the disease.

Reparative and absorptive processes in bone are next described. The clinical course of the disease as it manifests itself in the long and flat bones, its more common localizations, and other statistical matters having some bearing upon the understanding of the process are entered into, leading up to a discussion of the symptomatology, the interpretation of x-ray evidence, and a description of the special types,—as for example, epiphysitis, Brodie's abscess, etc. A chapter is devoted to the complications of the disease when near joints or associated with fractures, and the effects produced by interference with growth and as an incidence of deformity. Late sequelae,—*e.g.*, anaemia and various visceral complications, as amyloidosis—are emphasized.

In the chapter on treatment the various methods are given their rating according to the author's opinion, and the essentials for carrying out the radical cure are very minutely described. Curetting of sinuses and maggot treatment come in for destructive criticism, and wide open, complete exposure and eradication of necrosed bone is urged. The final chapters are devoted to particular types,—*e.g.*, those caused by typhoid and paratyphoid invasion and those resulting from pneumococci, influenza, and certain other rare organisms. Considerable space is devoted to the disease in the skull, the jaws, the sternum, and the vertebrae, where, because of proximity of important anatomical regions and vital structures, serious complications frequently take place. The volume represents a very thorough review of the entire field of acute and chronic, pyogenic, osseous infection, and offers in a clear-cut, definite fashion the best way to deal with the problems presented for treatment.

L'ÉPAULE. By Antoine Basset and Jacques Mialaret. Paris, Masson et C<sup>e</sup>, 1934. 65 francs.

In the first part of this book, the author has given an accurate description of the contours of the shoulder in all the different positions, with the landmarks in relation to the underlying structures, muscles, and bones, and these are then complemented by x-ray studies of the joints and of the neighboring bony structures in the same positions. These are followed by illustrations of the muscles and tendons, with outlines of the bony structures showing their regional relations; also included are roentgenograms showing the injection of the capsule, and indicating its relation to the structures entering into this

articulation. These illustrations, as well as all others in the book, are of exceptional clearness and demonstrate relation with accuracy. This part is a fitting introduction to the operative procedures later described.

From this basis of the anatomical study, the author has considered the usual approaches to the joints with reference both to the accessibility of different areas and to the safety of the important structures. Of these approaches he considers that there are but five which are in accordance with the anatomical and physiological principles and which, therefore, should be retained. These are described in detail, as well as the regions of the joint which are accessible through them.

The different affections and traumatic conditions of the joint and contiguous regions and the procedures and the various operations which are applicable to them are then discussed individually and in detail. Always the greater emphasis is placed on the choice and technique of the operation rather than on the diagnosis and pathology, although these are also considered, as well as such affections as tuberculosis, arthritis, injuries, etc.; and advice is given as to the approach which best serves each one. The description of the operative procedures is entered into in detail, and the adaptability of the various methods renders this portion of the work a most valuable guide.

The different types of fractures and dislocations of the shoulder joint are considered with reference to the surgical treatment. The author does not recommend surgical procedures to the exclusion of the conservative methods, but describes their use when necessary and gives the details of the approach and of the technique. He considers four varieties of fractures and six types of luxations. All dislocations, particularly of the recurrent type, are fully covered in his discussion.

The indications influencing the choice of methods of each procedure and the different steps in the various approaches are clearly shown by unusual photographs and drawings. A very valuable feature in the illustrations is the outline, placing all the underlying bone structures and demonstrating their relation to the overlying parts in the steps of each approach.

The book is the result of much research and is invaluable in the study of shoulder-joint surgery.

**FRACTURES.** By Frederic J. Cotton, M.D. *In Practice of Surgery*, edited by Dean Lewis, Volume II. Hagerstown, Maryland, W. F. Prior Company, Inc., 1934.

In the treatment of this subject by Dr. Cotton, one would expect a presentation out of the ordinary form, and the reader will not be disappointed. This is not a text-book repetition of the vast amount of literary information which is found in so many of the books on fractures. It is, rather, an exposition of the working of the author's mind in dealing with each of these types of injuries and his application of the methods which he has found useful.

The features of conciseness and clearness of expression and unequivocal statement in a presentation of detail are prominent in this work on Fractures by Dr. Cotton in Dean Lewis' "Practice of Surgery". It is seldom that one finds a treatise so evidently based on the results of a large personal experience and one in which the author has been critical of his own work, also critical in his observations on the methods which he has employed and the results which he has obtained. Particularly in a work on fractures, the routine features of diagnosis, methods, and means of treatment are so frequently described in detail that the guidance in their employment is often lacking, and it is, therefore, gratifying to find this welcome feature which will be appreciated by every practical surgeon, even those who have had extensive experience in dealing with this group of injuries.

The author has given in a clear and axiomatic way his opinions of the methods and the principles which are the outcome of a critical and accurate personal observation. Recognizing the questions which will always arise in the course of treatment of fractures, both as to the diagnosis and the choice of methods and of technique, the author has drawn

freely from his own experience and has so formulated his opinions that they serve as an aid in determining the course to pursue in dealing with this group of injuries. It is seldom that any hard and fast rule for the treatment of these injuries can be laid down; rather, the surgeon must depend on his judgment in each case.

As a preliminary to the consideration of various types of fractures, the author has taken the reader into his confidence in a sort of professional companionship, first by the definition of terms used and an almost elementary description of the methods and means which are employed, in order that by a "meeting of minds" the author and the reader may have a clear and mutual understanding of the technical language and definitions that are used, and that the two may, therefore, be in accord. Frequently it happens that, because of the lack of this mutual understanding of terms or principles of the methods which are described and of the procedures which are discussed, the mind of the reader wanders in too many detours from the direct path which the author has intended should be followed.

In the first portion, before taking up the consideration of the special fractures, the principles, methods, and means of treatment are discussed, and in the same manner the principles of splint fixation and of the general considerations of operation; also the principles of operations and methods of dealing with non-union and delayed union. In this portion of the work the author takes up the application of the principles which can be of guidance in a course of treatment of fractures in general, the choice of methods and technique, and the application of these to the individual cases. Especially has he sketched the limitations of methods and means which he has used. A particularly good example of this is the axiomatic directions which are given under the heading of "Principles of Operation". The results which reasonably may be expected from the various methods are discussed with a directness and frankness which is not usually encountered. The recorded failures of one's experience and the limitations and the difficulties encountered in the course of treatment serve as a valuable and practical guide to everyone who approaches the subject with an open mind.

In the discussion of the various types of fractures, the concise method of giving essential features is distinctly helpful to the reader who desires information as briefly and definitely expressed as possible. In this way are given the points of diagnosis, the aids for the choice of methods of treatment, and a description of the technique, as well as the probable results. Perfect results are not always to be expected. The discrepancy between the anatomical and functional results is a fact to be recognized, and the discussion of the features of prognosis in this respect will be of aid to the surgeon in giving a reasonable prognosis in the more difficult cases.

Advice on the procedure and technique in dealing with the old and with the mal-united fractures is particularly helpful. In following the course often advocated in this treatise, a surgeon of lesser experience should recognize that there are times when active and more radical methods, both in these and in many of the fresh fractures, are less safe in inexperienced hands than are other more conservative methods, which under these conditions will frequently yield more satisfactory results. Very considerable emphasis is given to many of the operative procedures, but the book is, however, safe in that it leans toward the non-operative methods when such give a reasonable assurance of good results.

**TECHNIQUE DU TRAITEMENT DES FRACTURES.** By Lorenz Böhler. Translated from the Fourth German Edition by M. Boppe. Paris, Masson et C<sup>ie</sup>, 1934. 160 francs.

The first book by Dr. Böhler made a place for itself in the medical world. His direct and decisive methods of dealing with fractures, his careful and efficient application of plaster and splinting, combined with the radical but reasonable methods and application of operation, have been of great interest to the surgical world, and have added a great deal to the efficiency of the treatment of these injuries. Because of the language, the book has not been too widely available to the general medical world as a book of reference. Both the English translation and two editions of the work in German have been

reviewed in this *Journal*,—the English translation in October 1929, the third German edition in July 1932, and the fourth German edition in January 1934. Its appearance now in French, edited by Masson et C<sup>ie</sup>, extends widely the horizon of usefulness of this valuable book.

In the first part, the discussion of the general principles of technique in the treatment of fractures is given, the result of an extensive experience in the unusual reduction of fractures. In the practical application of any method, it is of great value to have a thorough consideration of the principles of treatment, the methods used, and the means,—for instance, the apparatus used, the plaster, etc. Therefore, in this book the discussion of the principles, methods, and technique, and their application, including the operative measures, as well as the conditions which influence healing and non-union, will be helpful to the experienced surgeon, as well as to those who have had fewer opportunities.

This edition is translated by Dr. M. Boppe, *chirurgien des Hôpitaux de Paris*, with a preface by Prof. Hartmann. Dr. Boppe is especially qualified to transfer into another language this special treatise on the treatment of fractures. The emphasis which the original author has placed on his methods of dealing with the different groups and his individual attitude toward the treatment of fractures in general can be best transferred to another language by one who has been long connected with the treatment of these injuries. The practical experience allows him to express the clinical phases of an important work with greater distinctness and with accurate transfer of the idea of the author. Special interest will be found in the chapter dealing with the fractures of the spine and of the tarsus. Dr. Böhler's more recent methods of treatment of spinal fractures, radical as compared with the usually accepted methods, are striking and sometimes a little alarming to those who have not had this experience, but they carry weight when coming from a surgeon of his experience, and his results verify the claims made by him. Much the same can be said in regard to the portion of the book dealing with fractures of the tarsus, particularly of the os calcis. Dr. Böhler's active and rather radical methods in dealing with these injuries, as well as the success which he has attained through their use, are well recognized throughout the surgical world. This book will allow those to whom the German edition is not available to become more familiar with the details of this treatment and with the accurate application of the principles and methods long advocated by the author.

The illustrations in the entire book have been unusually well reproduced, and the text is abundantly supplemented by excellent roentgenograms, photographs, and drawings. The author's comments on the relation of the industrial complications which are so frequently associated with the treatment of this class of injuries are also particularly valuable because of the fact that his hospital deals almost entirely with this group of cases, and his experience is not only with the treatment of the fracture itself, but with the later results and the complications which arise because of its association with industry.

The emphasis of Dr. Böhler must necessarily be on the side of operations, because of the severe character of the class of fractures which must come to his hospital. In spite of this, however, the credit given to the conservative forms of treatment and the value of apparatus, are evident throughout the work.

**CLINICAL PATHOLOGY OF THE JAWS.** With a Histologic and Roentgen Study of Practical Cases. By Kurt H. Thoma, D.M.D. Springfield, Illinois, Charles C. Thomas, 1934. \$9.00.

This is a very comprehensive volume covering all aspects of jaw pathology. The photographs, x-ray reproductions, photomicrographs, and drawings are excellent. The various chapters on jaw pathology are illustrated by histories of cases from many hospitals and clinicians, both at home and abroad. The author has used much material from his own practice, but hundreds of the case histories have been obtained from other sources. It was only by exceedingly thorough search by the author and by much cooperation from his associates that such a fund of facts was accumulated. Every conceivable type of tumor is illustrated by a case report.

The first section of the book deals with malformations of the face, head, and jaws; then follow studies of the atrophic conditions, fractures, infections, and endocrine disturbances of the jaws. Nutritional disturbances, diseases of uncertain etiology, are considered from etiological, pathological, and therapeutic aspects. Several chapters are devoted to the various types of cysts.

Nearly one-half of the book is devoted to the tumors of the jaw, both primary and secondary. Brief résumés of the history and treatment are given in the case reports, but the ultimate outcome of many of the cases is not stated. This additional information would help in evaluating the treatment given.

KONSERVATIVE UND OPERATIVE ORTHOPÄDIE. By Prof. Dr. Julius Hass. Vienna, Julius Springer, 1934. 51.60 marks.

To the unusually fine orthopaedic texts which have already appeared in the German language, this newest arrival must be welcomed as a worthy companion volume. It is dedicated to Adolf Lorenz whose words have now matured on the printed page and in the mind of Julius Hass, his successor. The words have been sifted and are now arranged in logical chapters to form a single volume which defends the traditions of the *Allgemeinen Krankenhaus*, but presents also the innovations of the present Chief of Orthopaedics.

It is not a catalog of the various methods of treatment. The reader is given only the forms of therapy which are to be recommended, usually from personal experience. *Konservative and operative Orthopädie* belongs among the works of Whitman, Schanz, and Haglund with the "one man" books. Beginning with the simple wooden table and its supplementary apparatus, the semidiagrammatic drawings of Carl Hajek recall vividly the casts, splints, and methods in use at Prof. Hass's Clinic. The work on congenital dislocation of the hip, wry-neck, joint tuberculosis, and osteoclasia is particularly characteristic. The author's several original operations are given only their proportionate amount of space. His personal opinions are perhaps somewhat less valuable because of the omission of follow-up studies, except in a few cases.

Controversy over priority is wisely avoided by the accurate statement of facts. Some of the methods which rival those of Lorenz and Hass are discussed briefly, and there has been no attempt to include all representative operations.

Views on the etiology of congenital deformities have changed greatly, under the influence of Böhm and others, from the old mechanical theories to those of embryonal arrest and heredity. Rickets, on the other hand, is blamed for most of the cases of scoliosis not due to other obvious causes.

We hail a new work on orthopaedic treatment which is logically arranged and written to include all of the personal charm of the author. It is all the more readable, because of the subjective coloring for which the writer offers no apology. It is a valuable record and will be prized as a reference work by every orthopaedic surgeon.

HUMAN ANATOMY. Double Dissection Method. By Dudley J. Morton. New York, Columbia University Press, 1934. (In two volumes: First Dissection; Second Dissection. Two volumes, \$6.00.)

This laboratory text-book of Anatomy represents a new method,—the double dissection method—which has been under development during the past six years as an adaptation of the teaching of Gross Anatomy to the reduced time schedule which has been adopted in a majority of American medical schools. To accomplish this adjustment of teaching, the author has established a plan aiming "to retain the earlier standard through increased effectiveness in student effort, by remodeling the method of presentation along different pedagogic lines". The essential element of this plan is that the students working in pairs should perform, during the first-year course, "two dissections



of the entire body, the first being restricted to the larger structures and visceral organs, and the second applying chiefly to the vascular and nervous systems with a review of the larger structures".

In accordance with this method, Dr. Morton's manual is arranged in two volumes, one for each dissection. In the first volume are given detailed and tabulated instructions for a systematic dissection of the muscles, bones, joints, and viscera, with an abundance of diagrams, topical questions, and blank pages to be filled out by the student as a result of his studies. Under the caption of muscles, primary attention is devoted to their action and innervation; and under the heading of joints, to their range and type of motion. Similarly, the second volume outlines another complete dissection with reference to the nervous and vascular systems. In this study are included also a number of relations and smaller details and structures not noted in the first dissection.

In the necessary adaptation to a reduced time schedule which all teachers of anatomy have been obliged to make, Dr. Morton's method deserves thoughtful consideration. In schools where it has already been the practice for four students to work on a single cadaver, the necessity for doubling the number of subjects used may prove an insuperable obstacle to its adoption. However, even without increasing the amount of anatomical material consumed, it should be possible easily to combine the two dissections into one, adopting at the same time Dr. Morton's admirable manner of presentation and his method of directing the students' attention to essential details whereby they may learn from their own work rather than from systematic text-books, which all teachers agree should be employed for collateral reading and reference rather than as primary sources of knowledge. Certainly, the suggestions afforded by Dr. Morton's work may well be carefully considered and adopted in whole, or in part, in the teaching of Anatomy in American schools of medicine.

THE ANATOMY OF SURGICAL APPROACHES. By L. C. Kellogg. Baltimore, William Wood & Company, 1934. \$1.50.

This book is intended to be an aid to the younger surgeon and to many of the practitioners rather than to the experienced surgeon. The practical information which it contains will be found suggestive and frequently a valuable guide. A small book, giving the best approach to the desired part in the usual operation, it deals mainly with the simple technique and with the directions applicable to the procedures of lesser importance; but it also considers in the same way many of the major operations, and thus will serve as a practical guide to those who may wish this aid. Many will welcome it.

The author has made no attempt to intrude on the field of the technique of the various surgical procedures nor of the choice of the application of methods, but has restricted his considerations to the approaches to the fields of operation by the location of the important structures in or near the areas. By following these directions, much injury can be avoided and the most advantageous approach can be chosen, frequently with the result of avoidance of the production of unsightly and badly placed scars.

RÖNTGENDIAGNOSTIK DER KNOCHEN—UND GELENKKRANKHEITEN (Roentgenographic Diagnosis of Bone and Joint Diseases). By Prof. Dr. Robert Kienböck. Heft 3. Vienna, Urban & Schwarzenberg, 1934. 22.50 marks.

The third volume of the series, *Gelenksosteomatose und Chondromatose*, is concerned with a reclassification of joint disease. Under the roentgenographic diagnosis of *Gelenksosteomatose* (joint osteomatosis) are included the conditions ordinarily referred to as hypertrophic, trophic, and traumatic arthritis, as well as osteomata in or near joints. A few malignant bone tumors are thrown in under the caption of malignant chondromata.

The 225 pages comprise brief descriptions of sixty varied cases from the literature, which the writer has rediagnosed to suit his terminology, and thirty-eight excellent cases which he has seen personally and presented in detail with unusually good plates.

**AIDS TO OPERATIVE SURGERY.** By Cecil P. G. Wakeley, D.Sc., F.R.C.S. Ed. 2. Baltimore, William Wood & Company, 1934. \$1.25.

In the second edition of this small volume, the author has given a résumé of the principles and the steps in the technique of practically all of the recognized operations. At times even the experienced surgeon finds it convenient to refresh his memory in regard to some of the details in any operation and the surgeon of lesser experience will also find the information in this book a very distinct aid in the rapid revision of the steps in any operation.

In this brief form the author has presented the essential steps in the usual operations, giving the lines of approach, with the structures to be considered and to be avoided, and the general directions as to the technique of procedures. A portion is devoted to the surgery of bones and joints, tendons, and muscles. The reader will find in abstract form, in this little book, the classical procedures which are described in detail in the ordinary text-books on surgery.

**DIE WIRBELSÄULE IN DER UNFALLHEILKUNDE** (The Spine in Industrial Medicine).

Beihefte zur *Monatsschrift für Unfallheilkunde und Versicherungsmedizin*. Heft 18. By Ernst Ruge. Berlin, F. C. Vogel, 1934. 12 marks.

This monograph, consisting of 153 pages and containing forty-three illustrations, is a supplement to a monthly journal devoted to industrial medicine. The material consists of discussions on the normal and the pathological features of the spine, as they may occur following trauma. The reader notes a rather strict adherence to the opinions of a few authorities; in fact, the entire book is merely a review of the more recent literature. Being narrow in its scope, the value of the monograph is somewhat diminished by the style of presentation. The industrial or orthopaedic surgeon will find much of his own information and experience corroborated, and to him the book will be of interest.

*The Journal* wishes to acknowledge the receipt of the following publications sent to the Editorial Department:

Boletines de la Sociedad de Cirugía de Rosario (Argentina), I, Núms. 2, 3, 5, 6, 1934.

Bulletin of the National Tuberculosis Association (New York), XX, Nos. 10, 11, and 12, 1934.

The University of Chicago, Medical Schools, Announcements for 1934-1935. Chicago, 1934.

Illinois Medical Journal (Oak Park), LVI, No. 5, 1934.

Medico-Surgical Suggestions (Madras, India), III, Nos. 6, 7, 1934.

La Tribuna Médica (Havana), VIII, Nos. 224-229; IX, Nos. 230-233, 1934.

Programm des 54. Fortbildungskursus der Wiener medizinischen Fakultät (Vienna), 1934.

The Rockefeller Foundation. Annual Report for 1933. New York, 1934.

Conception Period of Women. By Dr. Kyusaku Ogino. English translation by Dr. Yonez Miyagawa. Harrisburg, Pa., Medical Arts Publishing Co., 1934.

Digest of the Proceedings of the Council of National Defense during the World War. By Franklin H. Martin. Washington, United States Government Printing Office, 1934.

Fifty Years of Medicine and Surgery. An Autobiographical Sketch. By Franklin H. Martin. The Surgical Publishing Company of Chicago, 1934.

**CONTRIBUTION À L'ÉTUDE DE LA NATURE DE LA TRANSPLANTATION OSEUSE** (A Study of the Fate of Bone Transplants). Helge Camitz, Hjalmar Holmgren, and Harald Johansson. *Acta Chir. Scandinavica*, LXXV, 1, 1934.

By interchanging homologous fragments of bone with its periosteum from the radius of sixteen dogs and then killing them from 2 to 196 days later, a microscopic study of the fate of bone grafts was completed. Among the numerous conclusions are the following:

Endosteal callus appears in about five days and is gone in forty-two.

Periosteal callus begins to form in seven days and is almost complete in 196 days.

Certain parts of the graft are probably reformed during the process of union, while others retain their original structures.

The periosteum and endosteum of the graft play no prominent part in bone regeneration, but preservation of the host periosteum is of the greatest importance.—*W. P. Blount, M.D., Milwaukee, Wisconsin.*

ÜBER LÄNGENWACHSTUM DER KNOCHEN UND TRANSPLANTATION VON EPIPHYSENSCHEIBEN (The Longitudinal Growth of Bones and the Transplantation of Epiphyses). Nils Silfverskiöld. *Acta Chir. Scandinavica*, LXXV, 77, 1934.

By accurate measurement of the distance between metal pins which he had introduced into the growing long bones of rabbits, the writer proved that there is no interstitial longitudinal growth of these bones. He also rechecked the tables of growth rate of the various epiphyses.

The possibility of epiphyseal transplantation was studied from all conceivable angles. Reimplantation and autoplasmic transfer to bone was followed by survival of the graft and considerable longitudinal growth. Homoplasty, heteroplasty, and autoplasty to other tissues than bone were uniformly unsuccessful.

Although the lengthening of a bone by autoplasmic transfer of an epiphysis is possible, the technical difficulties and lack of available epiphyses restrict the utility of the procedure.—*W. P. Blount, M.D., Milwaukee, Wisconsin.*

ERFAHRUNGEN ÜBER EINE VERSUCHSREIHE VON EXTRAARTIKULÄRER ARTHRODESE BEI HÜFTGELENKSTUBERKULOSE (Experiences with a Series of Extra-Articular Arthrodeses in Tuberculosis of the Hip). Rolf Eurén. *Acta Chir. Scandinavica*, LXXV, 129, 1934.

Complete bony ankylosis in a functionally good position is the best end result in a case of hip-joint tuberculosis. In nine cases of arrested tuberculosis, in which there was motion, fusion operations were performed and the results tested after two years or more. In four of the cases the trochanter had come to lie close to the acetabulum. In these the trochanter itself was sawed off and used as a graft. Two of the four cases were fused at two years. In five hips a tibial graft was used, and there were only two bony ankyloses. It was pointed out that the graft could not be expected to bear the weight of the body; that it acted merely as an "internal corset". The writer emphasizes the advisability of waiting until the process is inactive before attempting fusion. Various indications and reasons for failure are discussed. There are summaries of all of the cases and good roentgenograms of seven of them.—*W. P. Blount, M.D., Milwaukee, Wisconsin.*

NECROSIS OF THE FEMORAL EPIPHYSIS OWING TO INSUFFICIENT NUTRITION FROM THE LIGAMENTUM TERES. A Clinical Study Mainly Based on Experiences of the Treatment of Epiphysiolysis Capitis Femoris. Henning Waldenström. *Acta Chir. Scandinavica*, LXXV, 185, 1934.

On the basis of his studies of epiphysiolysis capitis femoris under conservative treatment, and after many closed and five open reductions, the writer concludes as follows:

1. If all connections with the caput femoris are cut off and the caput reduced, it unites with the neck but usually undergoes necrosis.
2. If all connections between the collum and the caput are cut except the ligamentum teres and the caput is put back in its place, it not only unites with the collum, but also remains living.
3. Necrosis of the caput, after attempts at reduction in epiphysiolysis capitis

femoris, is due to severance of the ligamentum teres during the reductive manipulations or, perhaps, occasionally to deficient vessels in the ligament.

4. Open reduction with preservation of the ligamentum teres is the best method of treating the extreme displacements. Moderate degrees are best treated conservatively.

A case of medial fracture of the femoral neck without displacement united quickly but, nevertheless, went on to necrosis of the femoral head. After operation only a few minute arteries were found on microscopic examination of the ligamentum teres. The cause of necrosis is to be sought in imperfect blood supply; the vessels of the ligamentum teres are missing altogether, or have become damaged at the time of fracture.—*W. P. Blount, M.D., Milwaukee, Wisconsin.*

**BONE FORMATION IN METASTASES OF OSTEOGENIC SARCOMA.** Report of Case with Metastases to the Brain. Warren G. Harding, II, and Cyril B. Courville. *Am. J. Cancer*, XXI, 787, Aug. 1934.

The authors report in detail with illustrations a case of primary osteogenic sarcoma of the femur with metastases which were capable of forming osteoid tissue and adult bone. One of these metastatic nodules was roentgenographically visible in the brain. In the discussion following the case report the authors review theories of osteogenesis and conclude that the present case favors the theory that bone formation is due to a specifically endowed cell, the osteoblast. As representing the alternative view, which considers bone to be simple connective tissue which has become calcified through some chemical process, they quote from Greig: "It is significant that no professional pathologist, even of wide experience, with whom I have discussed the matter, can recall from his own experience a single case in which even one metastasis from a periosteal or endosteal 'osteogenetic' sarcoma contained bone".—*Grantley W. Taylor, M.D., Boston, Massachusetts.*

**A FURTHER CONSIDERATION OF EWING'S SARCOMA.** Charles L. Connor. *Am. J. Cancer*, XXII, 41, Sept. 1934.

The author is convinced, in the light of further study, that among a group of tumors he had previously reported as Ewing's tumor there were a number which were cases of multiple myeloma or lymphosarcomatosis. He reports in detail with roentgenograms and photomicrographs three cases which he thinks clarify the characteristics of the tumor. He recognizes three histological types of Ewing sarcoma—a completely undifferentiated diffuse endothelioma, a cellular endothelial type forming vessels (angio-endothelioma), and a reticular type. He suggests that the tumor cell is a very undifferentiated mesenchymal cell which on occasion can form a cement substance and produce a relatively undifferentiated angio-endothelioma, and that it may become an osteoblast and form bone. He has discovered that metastatic lymphomatous tumors have been the most difficult to differentiate from endothelial myelomata.

There is a good discussion of the histogenesis of the tumor and a bibliography of the recent literature on the subject.—*Grantley W. Taylor, M.D., Boston, Massachusetts.*

**TUMORS OF TENDON SHEATHS, JOINTS, AND BURSÆ.** Charles F. Geschickter and Dean Lewis. *Am. J. Cancer*, XXII, 96, Sept. 1934.

The authors present a brief monograph on these tumors, illustrated by a careful study of the literature and of the material available in the Johns Hopkins surgical pathological laboratory. There is a brief presentation of the embryology of the structures involved, and its significance in determining the location and character of tumor development.

The common neoplasms of the tendon sheaths are benign osteochondroma, ganglion, and giant-cell tumor. All these tumors show a relationship to precartilaginous tissue. There is a definite correlation between the sites of giant-cell tumors and the occurrence of sesamoid bones. Fibroma, lipoma, hemangioma, and lymphangioma also may occur. Chondrosarcoma of the tendon insertion and fibrosarcoma of the tendon sheath are rare.

The most frequent tumors in the joint are benign osteochondromata or chondromata involving the synovia diffusely and giving rise to multiple loose bodies. Cysts and cartilaginous free bodies of questionable neoplastic nature may arise from joint cartilages. Xanthomatous giant-cell tumors apparently arise at the primordium of the sesamoids. Fibromata, fibrosarcomata, and lipomata have been described. Sarcoma invading the joint from the adjoining bone is relatively rare.

Tumors of the bursae are very rare. Benign and malignant chondromatous lesions and spindle-cell sarcomata predominate. The prepatellar bursae are most often affected.

This article is well illustrated with photographs of gross and microscopic specimens and roentgenograms, and includes a careful review of the literature and a good bibliography. The original article should be consulted for detailed description of the various tumors; and for the author's views on histogenesis, which are presented with considerable confidence even on the disputed and puzzling subjects of ganglia, xanthomatous tumors, and cysts of joint synovia.—*Grantley W. Taylor, M.D., Boston, Massachusetts.*

STUDIES IN BONE SARCOMA. II. Is New Bone Formation in Osteogenic Sarcoma the Result of a Local Supersaturation of Tissue Fluids with Calcium? Alexander Brunschwig and Paul H. Harmon. *Am. J. Cancer*, XXII, 342, Oct. 1934.

The authors conducted experiments in which calcium in several forms was injected into a growing transplantable mesoblastic tumor of rats. There was no new bone formation in the tumor in any of the thirty-seven animals used in the experiments. From these findings the authors conclude that calcium itself is incapable of rapidly bringing forth osteoblastic properties in malignant mesoblastic cells which do not exhibit such properties under usual circumstances of growth.

This study is not a particularly convincing argument against the humoral hypothesis for new bone formation in osteosarcoma.—*Grantley W. Taylor, M.D., Boston, Massachusetts.*

A DIETARY TREATMENT FOR TUBERCULOSIS. I. Results in Bone and Joint Tuberculosis. Henry Stempa. *Am. Rev. Tuberculosis*, XXX, 365, Sept. 1934.

The author bases his treatment upon the discovery of Setti and his followers that "animals fed upon a rich diet, but on a diet poor in vitamins and minerals, increased the virulence of tubercle bacilli injected into their blood or abdominal organs, but that tubercle bacilli injected into animals fed with sufficient vitamins and minerals lost much of their virulence". The total exclusion of salt from the diet produces intestinal upsets which weaken the resistance of the patient. Therefore, a total of two grams of salt is permitted each patient daily. Dehydration has a favorable effect upon chronic inflammations, infiltrations, exudations, dyskeratoses, and pus formations. Therefore, the administration of calcium, potassium, and magnesium is used to replace sodium with all its combinations and liquids.

Rest is important, not as a therapeutic measure, but as a supportive measure. Sun treatment is not used by the author. Reliance is placed upon "pure" vitamin D (viosterol) which can be given in known dosage, regularly, and throughout the whole year.

The clinical results referred to in this article warrant further study of the author's method.—*Clarence A. Ryan, M.D., Vancouver, Canada.*

KLINISCHE BEOBSACHTUNGEN ÜBER DIE HEILUNG SUBCHONDRALER KNOCHENAUSSPRENGUNGEN (Clinical Observations on Healing of Subchondral Bone Separations). Max Ernst. *Arch. f. klin. Chir.*, CLXXIX, 637, 1934.

By clinical and roentgenographic follow-up examinations of joint injuries with separation of very small osteocartilaginous particles, it is demonstrated that healing in the subchondral area has certain characteristics. The separated bony particles are visible for years in the same position. Joint function is thereby not impaired, in spite of non-union.

The treatment of such injuries has three important requirements:

1. A fresh joint injury with subchondral separation is not to be treated as a bone injury, but as a sprain or tear; prolonged immobilization is not indicated.
2. The isolated bone shadows, demonstrable by the x-ray for years, are not to be confused with free joint bodies. In spite of incomplete anatomical healing—failure of bony union—the joint mechanism is intact.
3. The so-called temporary chiseling off of a bony projection, for the purpose of obtaining a better view in joint operations, should not be undertaken in the subchondral area, on account of the defective bony union that may follow.—*R. J. Dittrich, M.D., Fort Scott, Kansas.*

BEITRÄGE ZUR DIAGNOSE UND PROGNOSE VON KNOCHENGESCHWÜLSTEN (Contributions to Diagnosis and Prognosis of Bone Tumors). Rolf Glauner. *Arch. f. klin. Chir.*, CLXXIX, 672, 1934.

In an analysis of seventy-seven cases of bone tumor, there were ten cases of benign tumor, forty-nine cases of sarcoma, and eighteen cases of localized osteitis fibrosa and osteitis deformans of Paget.

Benign bone diseases, simulating typical malignant conditions (localized osteitis fibrosa and osteitis deformans), can with certainty be differentiated histologically from true sarcomata. The clinical and roentgenographic methods of examination are inferior to the histological methods. Therefore, biopsy is indicated.

Osteitis fibrosa, as seen in the x-ray, may be mistaken for partly or completely degenerated chondroma or osteoma, but more often chondrosarcoma, and their metastases. It is, therefore, advisable to curet the cavity and examine the material histologically. In case of a localized osteitis fibrosa, curettement offers a good prognosis. When the lesion is extensive, or if there is a tendency to recurrence, resection is the method of choice.

True sarcomata have a high mortality with any form of treatment. Most of the few patients cured for many years have had deep x-ray treatment before and after a radical operation. The histological picture shows a fibrosis produced by the irradiation.

Ewing's sarcoma, also, can be correctly diagnosed only by histological study, for it does not, as is usually stated, occur in the shaft of long bones, but is situated near the joints. For the purpose of correct therapy, it is very important to make an accurate diagnosis in this type of tumor.

Only in rare cases does trauma play a part in the origin of a true sarcoma. Localized osteitis fibrosa, on the other hand, can be traced back in every case to a definite trauma, so that a relationship can be established as regards time and locality.

The histological picture of localized osteitis fibrosa corresponds to that given in the literature. In children before puberty, it may be impossible to differentiate between osteitis fibrosa and sarcoma; in some instances the finding of typical giant cells is the deciding factor.

In no case under observation was there a transition from the localized form to the generalized form of osteitis fibrosa, and no endocrine disturbances were noted in the localized form. Localized osteitis fibrosa is an independent disease of childhood and is produced by trauma.

Osteitis fibrosa (Paget) is often difficult to differentiate histologically from an advanced osteitis fibrosa. Localized osteitis fibrosa is to be included among the pre-sarcomatous diseases.—*R. J. Dittrich, M.D., Fort Scott, Kansas.*

ÜBER DIE GESCHWÜLSTE DER KLEINEN KNOCHEN AN HÄNDEN UND FÜSSEN (Tumors of the Small Bones of the Hands and Feet). T. v. Matolesy. *Arch. f. klin. Chir.*, CLXXIX, 708, 1934.

During a period of ten years, observations were made on fifty-eight cases of benign and malignant tumors. Of these, there were nine osteomata, nine chondromata, four brown tumors, and thirty-six sarcomata. These figures do not include exostoses of inflammatory origin.

The following principles of treatment were found to be most satisfactory:

1. In benign tumors, including brown tumors, treatment should be conservative; it should be limited to resection or curettement.
2. In sarcomata of central origin, in the early stage where the process has not passed beyond the cortex, it is sufficient to remove the tumor from the affected bone. The defect may be restored by means of a bone graft.
3. In the case of a periosteal sarcoma, where the tumor has invaded the surrounding soft tissues, and in the absence of metastases to the lungs, only a radical procedure can give any hope of success.—*R. J. Diltrich, M.D., Fort Scott, Kansas.*

RECONSTRUCTION OF THE FOREARM AFTER LOSS OF THE RADIUS. R. Watson Jones. *British J. Surg.*, XXII, 23, July 1934.

The Hey Groves operation was used in a girl of nineteen who had had a diaphysectomy for osteomyelitis. The operation consisted of implanting the distal end of the ulna into the small distal end of the radius. As a preliminary operation the inferior radio-ulnar dislocation was reduced to get rid of the prominent bulge at the lower end of the ulna.

The cosmetic results, as shown by the photographs, were excellent. There was, of course, complete loss of radio-ulnar movement. Wrist motion was 80 per cent. of normal. With the aid of the shoulder muscles it was possible for the patient to obtain the full palm-down position of the hand and also to bring the palm up to the face and neck.—

*Ernest M. Daland, M.D., Boston, Massachusetts.*

PROTRUSIO ACETABULI (Central Luxation). F. Campbell Golding. *British J. Surg.*, XXII, 56, July 1934.

A simple classification, based on etiology, if known, and on the roentgenographic findings, is suggested: (1) a group based on growth disturbances, (2) the rheumatic group, including gonococcal and non-specific infections, and metabolic arthritides, and (3) a group based on gross destructive disease.

Ten cases of intrapelvic protrusion of the acetabulum, illustrating these groups, are cited.—*Ernest M. Daland, M.D., Boston, Massachusetts.*

BONE-GRAFT FOR NON-UNION OF THE CARPAL SCAPHOID. Gordon Murray. *British J. Surg.*, XXII, 63, July 1934.

An operation is described for use in non-union of the carpal scaphoid. The author does not state the time limit for union or whether the operation should be used in fresh fractures to prevent non-union. The essential difference in the technique from that in use in other clinics is the passage of the graft through the fragments via a drill hole.

The incision is made along the radial surface of the wrist joint, extending one and a quarter inches upward and downward from the radial facet of the scaphoid, with the hand in full adduction. The tuberosity of the scaphoid is exposed by retracting the radial nerve and vessels and the abductor tendons of the thumb anteriorly and the extensor pollicis longus tendon posteriorly. A small area of the tuberosity is removed by rongeurs.

A transverse incision is then made in the dorsal capsule of the wrist joint and the fracture line exposed. A five-sixteenths-inch bit is used to drill through the two fragments, starting in the rongeur area of the tuberosity. A piece of cortical bone from the tibia is passed through the drill hole. Great care is taken not to destroy any cartilage during the drilling and not to leave any overhanging graft.

Details of five cases are given with a note that four more have been successfully treated. These cases were operated on two, four, one, seven, and five months, respectively, after injury. In each case the hand was kept in a cock-up plaster for eight weeks. Bony union took place and there was complete restoration of function.—*Ernest M. Daland, M.D., Boston, Massachusetts.*

**ADOLESCENT KYPHOSIS.** J. M. Edelstein. *British J. Surg.*, XXII, 119, July 1934.

Kyphosis in healthy adolescents, with no relation to Pott's disease, is sometimes known as Scheuermann's disease. It is most prevalent in boys and may be accompanied by a scoliosis. Various theories of the etiology are discussed. The conclusion is reached that the disease is due to a nutritional error, working in the epiphyses at the time when they are the most active.

Treatment is most effective in the early stages; an attempt is made to minimize the deformity. The patient is kept in a recumbent position for at least three months and then allowed to get up with a plaster spica or a leather support. Very little can be done after the deformity has developed.—*Ernest M. Daland, M.D., Boston, Massachusetts.*

**TWO HUNDRED AND SEVENTY CASES OF FRACTURED SPINE RADIOLOGICALLY CONSIDERED.** Owen L. Rhys. *British Med. J.*, I, 655, 1934.

Rhys, radiologist of the Cardiff Hospital, has seen 270 cases of fracture of the spine in five years. This large number of cases is the result of the fact that coal mining is the principle industry in Wales. The article is brief and suffers from incomplete discussion of the subject, but it contains some unusual statements. The author states that the commonest type of fracture is that associated with delayed collapse of the vertebral body (Kümmell's disease). The question of disability is discussed, especially in its relation to workmen's compensation. His impression is that, generally speaking, the disability is less than might be expected from the x-ray appearance, although the knowledge that compensation for the injury may be obtained has a great psychological effect.

—*R. I. Harris, M.B., Toronto, Canada.*

**PATHOLOGICAL FRACTURE IN GUMMA OF TIBIA.** I. Roland Jordan. *British Med. J.*, I, 665, 1934.

The author reports an interesting, and in these days unusual, case of fracture of the tibia through a gumma. A swelling of the skin ulcerated after several months and then, following a prolonged period of pain, a pathological fracture occurred. The x-ray showed localized destruction of the tibia. Despite a negative Wassermann, biopsy showed the lesion to be inflammatory and specific.—*R. I. Harris, M.B., Toronto, Canada.*

**CERTAIN INJURIES OF THE KNEE-JOINT.** T. P. McMurray. *British Med. J.*, I, 709, 1934.

The diagnosis and treatment of all the common injuries of the knee joint are discussed carefully and in detail.

In considering the treatment of rupture of the crucial ligaments, the author damns with faint praise the reconstructive operation of Hey Groves. In view of the brilliant



results obtained by Gallie and by Tees, this can only indicate unfamiliarity with the value of living sutures and free tendon transplants.

Ruptures of the internal and external lateral ligaments are adequately dealt with.

There is a very full and informative discussion of the mechanism of injuries of the semilunar cartilage and their diagnosis. The author rightly states that diagnosis is the most important step in treatment. He describes a special sign by which he is able to detect a break in the cartilage posterior to the level of the internal lateral ligament, an especially difficult diagnosis to make. He advocates removal through a small rather than a large incision.—*R. I. Harris, M.B., Toronto, Canada.*

COMPARATIVE ASPECTS OF LOUPING-ILL IN SHEEP AND POLIOMYELITIS OF MAN. W. S. Gordon. *British Med. J.*, I, 885, 1934.

In this article attention is called to a most interesting fact,—the close parallelism between poliomyelitis and an epidemic disease of sheep known as louping-ill. This is a virus infection transmitted by ticks, giving rise to a systemic reaction with a marked tendency to involvement of the central nervous system. The seasonal incidence, the age incidence, the abortive types of cases, and the lasting immunity conferred by one attack are strikingly similar to poliomyelitis in human beings.—*R. I. Harris, M.B., Toronto, Canada.*

A NOTE ON THE TREATMENT OF ACUTE INFECTIVE ARTHRITIS OF THE KNEE-JOINT. T. B. Mouat. *British Med. J.*, I, 980, 1934.

For the treatment of suppurative arthritis of the knee the author advocates drainage of the areolar tissue beneath the suberureus, in addition to drainage of the knee joint. This is based upon sound observation. Suppurative arthritis of the knee which does not do well is usually characterized by extension of the disease beyond the joint into fascial planes between muscles and especially beneath the erureus. A useful point in determining whether a punctured wound over the knee has penetrated the knee or not is to inject ether into the knee joint. If there is an open communication between joint and wound, the ether will boil out of the wound.—*R. I. Harris, M.B., Toronto, Canada.*

LATE TENDON SUTURE. Erie I. Lloyd. *British Med. J.*, II, 165, 1934.

The value and importance of suture of tendons—especially large tendons, such as the triceps and tendo achillis—weeks or months after the injury are discussed, and three successful cases are described in detail. The technique consists of adequate exposure, relaxation of the tendon by flexion of the adjacent joints, and accurate suture with chromic catgut reinforced with a free tendon graft from the peroneal tendons.—*R. I. Harris, M.B., Toronto, Canada.*

A SECOND ATTACK OF ACUTE POLIOMYELITIS. Thomas Moore. *British Med. J.*, II, 166, 1934.

Moore records an interesting case of a child seven years of age who had had poliomyelitis at the age of ten months which resulted in paralysis of the lower extremities. Six years later he suffered another attack involving the trunk and arms. On both occasions he was treated in the hospital and accurate records of the observations are available. The observations seem authentic.—*R. I. Harris, M.B., Toronto, Canada.*

ACTINOMYCOSIS OF THE HUMAN BODY. M. N. De and K. D. Chatterjee. *Calcutta Med. J.*, XXIX, 149, Oct. 1934.

Only one section of this article, that entitled "Actinomyces Maduræ", will be of interest to readers of *The Journal*.

Rare as actinomycosis is in this country, the special variety of this disease known as "Madura foot" is even more rare. Madura foot is caused by the ray fungus, first recognized in 1877 by Bollinger in pus from the so called "lumpy jaw" of cattle. In 1878 Israel found the same organisms in man. Actinomyces maduræ was first isolated by Vincent in 1894. The inflammation caused by the organism is a productive one and involves the foot most commonly. Unlike the variety found in cattle, it does not metastasize and is not favorably influenced by potassium iodide, as is actinomyces havis. It occurs quite commonly in Madura, a province in the Madras district of India, where the inhabitants wear no sandals. The lesions occur first on the soles of the feet and deform the foot almost beyond recognition through productive inflammation, formation of sinuses, and contracture of the newly formed connective tissue. It extends by contact. The lymphatics are not involved and no internal organs are ever attacked. Pus from the sinuses contains the typical granules which, when crushed and stained, reveal the characteristic "ray fungi". For its treatment, operative surgical measures are the only ones effective.—Charles F. Painter, M.D., Boston, Massachusetts.

TRATAMIENTO RECONSTRUCTIVO DE LA PARÁLISIS INFANTIL. NUESTRA EXPERIENCIA CON LA ARTRORISIS POSTERIOR DEL TOBILLO POR EL MÉTODO DEL BLOQUEO ÓSEO DE CAMPBELL EN EL TRATAMIENTO DEL PIE PÉNDULO PARALÍTICO (Reconstructive Treatment of Infantile Paralysis. Our Experience with Posterior Arthrodesis of the Ankle by the Bone-Block Method of Campbell in the Treatment of Paralytic Drop-Foot). Alberto Inclán. *Cir. Ortop. y Traumatol.*, II, 147, 1934.

Prof. Inclán in *Cirugía Ortopédica y Traumatología* reports the result of his experience with the use of posterior arthrodesis of the ankle in cases of infantile drop-foot. In reviewing the last forty cases of infantile paralysis in which he operated, he finds that the majority of these operations were to correct deformities of the foot. Of thirty-three foot operations, six were for drop-foot. In these six cases a triple arthrodesis was done with the posterior bone block for the ankylosed joint according to the method of Campbell. The author states that he has substituted this operation for astragalectomy, which he now uses only in cases of calcaneus cavus and calcaneus valgus. He also has replaced the use of fascia for artificial ligaments and the panastragalar arthrodesis by this posterior bone-block method which he considers gives better results. The cases are well illustrated and the technique of the operation is described in detail.

BEITRAG ZUR ELLBOGENVERLETZUNG DES KINDES. DIE EPIPHYSEOLYSE DES PROXIMALEN RADIUS ENDES, IHRE ENTSTEHUNG UND BEHANDLUNG (Contribution to the Study of Elbow Injuries in Childhood. The Cause and Treatment of the Separation of the Epiphyses from the Proximal End of the Radius). Robert R. v. Oppolzer. *Deutsche Ztschr. f. Chir.*, CCXLIII, 427, 1934.

The type of injury under discussion is an epiphysiolysis of the upper end of the radius.

A description is given of a closed method of reduction, applicable even in cases of marked dislocation of the epiphysis. Under anaesthesia, the forearm is brought into full extension and supination. Under traction, the elbow is placed on the thigh of the surgeon, using this as a fulcrum to force the forearm into a position of varus. These procedures are intended to widen the joint space between the radius and the humerus. With his thumb, the surgeon produces pressure on the dislocated head of the radius to force it medially and proximally, and at the same time slowly pronates and flexes the

forearm. Immobilization in a mild degree of pronation is carried out by means of a molded plaster splint which is left in place for two to three weeks, after which physiotherapeutic measures are instituted.

In this report are included eight cases treated by this method, one case in which operative measures were employed, and one case of application of this procedure in treating epiphysiolysis of the lateral condyle of the humerus.

The article contains valuable illustrations demonstrating the mechanism of production of this type of injury, the technique of reposition, and the x-ray findings.—*R. J. Dittrich, M.D., Fort Scott, Kansas.*

ENTWICKLUNG, STAND, UND AUSSICHTEN OPERATIVER SKOLIOSENBEHANDLUNG (Development, Status, and Outlook in Operative Treatment of Scoliosis). Ernst Bergmann. *Deutsche Ztschr. f. Chir.*, CCXLIII, 439, 1934.

In a brief historical review, the author traces the development of the operative treatment of scoliosis. Of particular interest are reports of two cases treated by means of rib resection, according to the method of Sauerbruch. The results are not encouraging, and the conclusion is reached that the most useful method of operative therapy is a fusion of the spinal column.—*R. J. Dittrich, M.D., Fort Scott, Kansas.*

FACTORS THAT INFLUENCE RHEUMATIC DISEASE IN CHILDREN. Based on a Study of 1,200 Rheumatic Children. Albert D. Kaiser. *J. Am. Med. Assn.*, CIII, 886, Sept. 22, 1934.

Rheumatic infection is a common complaint in certain sections of the country. It occurs at all ages of childhood, but more frequently between the ages of eight and ten.

Rheumatic disease may manifest itself with mild symptoms,—such as sore throat, fatigue, anorexia, and pallor. The infection is essentially a chronic one and tends to recur in more than 50 per cent. of the cases.

Rheumatic infection occurs slightly more often in children whose tonsils have not been removed at the time of the initial attack. Although numerous efforts have been made to associate a streptococcic infection with rheumatic disease no evidence has been presented to make this relationship certain.

Tonsillitis or sore throat was the preceding infection in 59 per cent. of the children with rheumatic disease. The most severe cases followed tonsillitis and dental infections. Respiratory infections are an important factor in causing recrudescences of the rheumatic phenomena. One may assume the existence of some constitutional susceptibility to rheumatism, but no proof of it is available.—*Ike Kendrick, M.D., Dallas, Texas.*

FOOT IMBALANCE. Rex L. Diveley. *J. Am. Med. Assn.*, CIII, 1510, Nov. 17, 1934.

The author classifies foot imbalance as follows: (1) pronated foot with a low longitudinal arch; (2) high arched, adducted foot with a contracted plantar fascia and a prominent ball.

The first step toward correction is the ordering of a proper shoe of the blucher type, having straight inner lines and a not too abrupt outer curve, with ample room in the cap and ball of the shoe. Heels should be of the straight side type, three-quarters of an inch high for men and an inch and a half or an inch and two-thirds high for women. The heel and vamp should fit snugly and firmly, with a built-in support in the shank.

After the proper shoe is selected, a correct type of support should be inserted. The author uses a sponge rubber of fairly firm consistency, molded in various sizes and composed of two principal parts,—the anterior and longitudinal supports. The anterior part of the support fits in the shoe just behind the head of the second, third, and fourth metatarsals. A support of this type may be skived to fit the individual arch.

In addition to proper shoes and inlaid supports, the author recommends toe-gripping exercises, with the foot in adduction, combined with stretching of the tendo achillis.—  
*W. B. Carrell, M.D., Dallas, Texas.*

TRAITEMENT NOUVEAU DES FRACTURES DU COL DU FÉMUR (A New Treatment for Fractures of the Neck of the Femur). G. Blanchard. *Phare Méd. de Paris*, March 1934.

The author describes his method of treatment in fractures of the neck of the femur, which he claims has the advantage of marked simplicity. Vertical traction is made on the hip by a specially constructed band about the flexed knee, and traction is made by a pulley from the ceiling. No other apparatus is used. Sufficient traction is made to raise the pelvis from the body side on the table. The patient rests on the opposite foot and on the shoulders, which brings the leg into flexion, abduction, and eversion. With the patient in this position, and by means of his own weight, displacement is reduced and shortening is overcome without undue force and, the author claims, without pain. Without moving the patient, plaster is applied, including the leg, body, and chest. The method is simple, painless, rapid, and secure. Fifty-four cases were treated with particular success. No anaesthetic was used.

VINGT ANS D'EXPÉRIENCE D'ARTHROPLASTIE (Twenty Years' Experience with Arthroplasty). V. Putti. *Presse Méd.*, XLII, 1321, Aug. 22, 1934.

Putti notes that the principles of arthroplasty enunciated by Ollier and Verneuil—excision of sufficient bone, interposition of soft tissue, separation of the ends of bone by traction, gentle and methodical immobilization of the joint after the preliminary post-operative reaction has subsided—are still the important criteria in the performance of arthroplasty.

Arthroplasty is best performed in patients between the ages of twenty and fifty years who have no hereditary or constitutional weakness, no chronic disease, nor any rheumatic diathesis. Those cases which show bony ankylosis are preferable, but, in any case, no patient should be submitted to arthroplasty in whom there is any sign of activity, even the slightest pain.

Putti maintains that the exposure should be large enough to permit the joint space to be made as near normal as possible. The fascia lata acts only as a temporary means of preventing fusion of the bone surfaces, since it disappears from the joint within sixty to seventy days. In several cases in which the author has reoperated on the patients, he has observed the formation of connective-tissue bands in the intercondylar space, which seem to partake both of the form and function of the crucial ligaments. If the capsular ligaments of the joint have not been destroyed, very excellent stability of the joint will be maintained. To secure mobility, traction should be continued for a period of ten to twelve days before gentle active and passive motion is begun. The traction must be continued for a prolonged time during treatment, and all movements of the joint should be within the limit of pain. Any evidence of a postoperative reaction, or a reaction following motion of the joint, should indicate cessation of all movement until the inflammatory symptoms have disappeared. Where the range of motion following operation is about 30 degrees, the prognosis for gradual progressive increase in the range of motion is good.—*Henry Milch, M.D., New York, N. Y.*

ARTHRALGIES ET MYALGIES BARBITURIQUES (6 nouvelles observations) [Barbituric Arthralgia and Myalgia (Six New Cases)]. P. Castin et P. Gardien. *Presse Méd.*, XLII, 1536, Oct. 3, 1934.

The authors call attention to the fact that true myalgia and arthralgia develop

after prolonged treatment with drugs of the barbiturate groups. The drug must be used in moderately large doses for a period of at least four months before the appearance of symptoms.

The scapular region is most frequently involved. The hips, the arms, the finger joints, the knees, the elbows, and the thighs are next in order of frequency. The pains occur as severe cramps with intolerable paroxysms of pain: The exact cause of these pains is not known. They may be due to some impurities in the drugs, a hepatorenal insufficiency, or to the formation of some biproduct which, like uric acid, has a special affinity for the muscles and joints.

The antirheumatic drugs—such as aspirin, antipyrine, and the salicylates—have no effect on these pains, but occasionally a liniment—consisting of salicylic acid, 10; 70 per cent. alcohol, 50; and castor oil, 100—seems to give relief; otherwise the drug must be discontinued.—*Henry Milch, M.D., New York, N. Y.*

CALCINOSE SOUS-CUTANÉE GÉNÉRALISÉE ET OSTÉOGÉNIQUE DE L'ENFANCE (Generalized and Osteogenic Subcutaneous Calcinosis). R. Turpin, C. Brun, et Ch.-O. Guillaumin. *Presse Méd.*, XLII, 1561, Oct. 6, 1934.

The authors call attention to the fact that calcinosis may be divided into two types: (1) the subcutaneous type, described by Cornil-Milian, and (2) the type described by Thibierge-Weissenbach, in which the calcinosis is associated with sclerodactylia, chronic rheumatism, etc.

The patient whom they describe appears to have had a generalized calcinosis involving the axillary glands, the fascia over the pectoral muscles, the fascia of both legs, and the abdominal walls. At the outset, the patient manifested symptoms of fever, sweating, pain, vomiting, and diarrhoea. The second stage of the disease was characterized by a generalized calcinosis, infantilism, cachexia, and death from intercurrent infections. In addition to the wide-spread deposition of calcium, in one mass of which true bone was being formed, the authors noted changes in the spleen, evidence of abnormal activity in the eosinophilic areas of the pituitary, interstitial sclerosis of the thyroid, hyperplasia of the adrenal, hypoplasia of the testicle, atrophy of the thymus, and fatty degeneration of the liver. The basal metabolism was normal. The blood examination showed diminution of sugar and urea, with an increase in the mineral constituents.

The authors are inclined to classify their case as the second type of calcinosis, but they call attention to the fact that the appearance of true bone formation in one of the calcific areas may in some way connect this type of case with that of myositis ossificans.—

*Henry Milch, M.D., New York, N. Y.*

LES ANGIOMES VERTÉBRAUX (Vertebral Hemangiomata). J.-A. Lièvre. *Presse Méd.*, XLII, 1571, Oct. 6, 1934.

Vertebral hemangiomata are more common than has been suspected, and they occur more often in youth and adolescence. Thus far they have been more frequently noted in women. These tumors may betray themselves by signs either of pain or of medullary compression of the spinal cord.

The diagnosis may be established clinically before operation by means of the x-ray, which is quite characteristic and which shows a diffuse mottling or porosity of the vertebra.

The treatment of this condition may be conservative or surgical. The surgical treatment is, of course, very dangerous because of the likelihood of uncontrollable hemorrhage. The author is inclined to the opinion that treatment by x-ray is quite as satisfactory and less dangerous. It may lead to a cessation of the pain and even to disappearance of the symptoms of the medullary compression as a result of shrinking of the tumor.—*Henry Milch, M.D., New York, N. Y.*

À PROPOS DE LA RÉDUCTION DES FRACTURES DE LA COLONNE VERTÉBRALE (Reduction of Fractures of the Vertebral Column). Jean-Paul Grinda. *Presse Méd.*, XLII, 1572, Oct. 6, 1934.

The author reports two cases of fracture of the spine treated by Böhler's method.

Reduction should be performed immediately under local anaesthesia, the anaesthetic being injected directly into the blood clot. General anaesthesia is contra-indicated. The method employed is that of traction, as advised by Böhler. Even in cases where the fracture is associated with injury to the spinal cord, attempts at reduction should be immediately undertaken. In fractures of the cervical region, where anterior angulation of the cervical column has occurred, traction should be applied to the head with the shoulders elevated, so that the head gradually may be brought into complete extension. In fractures of the cervical spine where the displacement of the fragment is associated with extension of the head, traction should be applied with a block under the head and the shoulders flat, so that the head may gradually be brought into flexion.—*Henry Milch, M.D., New York, N. Y.*

INFECTIOUS GRANULOMAS OF BONES AND JOINTS, WITH SPECIAL REFERENCE TO COCCIDIOIDAL GRANULOMA. Ray A. Carter. *Radiology*, XXIII, 1, July 1934.

Occasional infections of bone and joints are caused by pathogenic fungi. They include blastomycosis, coccidioid granuloma, actinomycosis, mycetoma, and torulosis. Because of their comparative rarity and their clinical and roentgenographic resemblance to more common infections, they are readily overlooked. Diagnosis frequently comes as a surprise upon recognition of the organism.

Positive diagnosis depends upon identification of the organism, which requires general alertness. Proper cultures and animal inoculation are required, since the organisms are frequently not recovered by direct examination of discharges and tissues. Repeated animal inoculation is sometimes required.

The author presents his findings obtained from a study of seventy cases of coccidioid granuloma.

By extension, lesions of bone may occur from an adjacent primary infection of the skin. A granulomatous node or intractable infection of the skin develops into a slowly growing ulcer which may invade deeper structures.

Origin in bone may be central or peripheral, epiphyseal or diaphyseal, in a region of cancellous bone.

Osseous involvement is predominately destructive, complete, or a partial "permeation". Margins of lesions may be "punched out" or diffuse.

Bone production is variable: many foci have none, some have it marginally, and a few have it within the area of destruction. It rarely predominates.

Early or rapid lesions tend to partial destruction without production; chronic lesions, to complete central destruction, marginal osteogenesis, and circumscribed borders. The infections are intractable; they may halt, but they seldom retrogress. Efficient healing is exceptional, but has been seen after intensive treatment by colloidal copper, vaccine, and vigorous supportive measures.

Productive periostitis occurs frequently, but not necessarily, with superficial involvement of bone. Periosteal bone is seldom smooth and well organized, but remains irregular and incomplete. It is without parallel lamination, but frequently shows perpendicular striation. Such bone has a cystic appearance, either single or multilocular, and is circumscribed by more or less well organized bone.

Epiphyseal cartilage and articular structures are an incomplete bar to extension.

Rapidity of advancement is very variable, but slower than is the case in acute osteomyelitis; several weeks or months are required for a display of progress in the roentgenogram. Non-periosteal bone production is particularly slow.

Joints are usually involved from an adjacent infection of bone or soft tissue. The only roentgenographic evidence of involvement may be excess articular fluid.

In a survey of forty-three joints, involvement appeared predominately osseous in twenty; general, in ten; predominately articular, in thirteen; and, in four, purely arthritic, without destruction of bone except the articular cortex. Since the majority of all lesions are purely osseous and those which involve the joints are not predominately articular, this predilection appears contrary to that of tuberculosis.

The only clear propensity shown is to destruction of articular cortex and cartilage adjacent to bone destruction. No selective destruction of cartilage at weight-bearing points, as described by Phemister in infectious arthritis, was seen in the author's cases.

Skeletal mycotic infections appear by group survey to resemble each other more than the common infections,—tuberculosis, pyogenic infection, and syphilis. They resemble tuberculosis more closely than the other two. Coccidioidal granuloma and blastomycosis are very similar.

What may be termed "mycotic predilections" include: lesions solitary rather than scattering; selective involvement of spongy bone; articular lesions obviously extended from bone; local infections intractable to conventional treatment; multiple foci—including non-skeletal, cutaneous, subcutaneous, glandular, and pulmonary foci; greater invasiveness than in most infections but, in spite of this, less tendency to involve tubular bone. The more acute widely disseminated tuberculous involvements are particularly mycosis-like. Punched-out lesions of the skull, involvements of the spine not limited to vertebral bodies or intervertebral discs, and intrathoracic infections which penetrate the chest wall are particularly suggestive. Positive diagnosis cannot be made from the roentgenogram alone.—*Edward N. Reed, M.D., Santa Monica, California.*

#### DIFFERENTIAL DIAGNOSIS OF INJURIES OF THE SPINE. Howard P. Doub. *Radiology*, XXIII, 267, Sept. 1934.

Compression fracture of the spine is very frequent and comprises about 40 per cent. of all spinal fractures.

Individual vertebrae in various areas may be simultaneously involved. Differential diagnosis should take into account preexisting unsuspected lesions.

Roentgenographic examination of the spine is extremely important even in cases with histories of slight or uncertain injuries; and the evidence of fracture may be confined to minute breaks in the margin of the body. Angulation of the spine, either posteriorly or laterally, is very suggestive. The disc shows little or no narrowing, such as is present in tuberculosis. However, with rupture of the nucleus pulposus, narrowing of the intervertebral space may occur.

Cases in which healing has taken place also show narrowing or obliteration of the space, with bony union of the vertebrae. In the anteroposterior view there is often narrowing in the superior-inferior diameter, with widening in the lateral diameter, and an associated lateral angulation.

Repair is slow and lipping at the vertebral margins is usual after about three months,—nature's attempt to immobilize the spine.

Fracture of the transverse processes is most frequent in the lumbar region; here this fracture must be differentiated from rudimentary rib which is characterized chiefly by its smooth, eburnated articular end.

Dislocation of the spine, unaccompanied by fracture, takes place almost always in the cervical area. It is usually unilateral, but, at times, occurs bilaterally and is much more serious.

Spondylolisthesis is common and, the author believes, is nearly always the result of a congenital anomaly of the spine.

Spina bifida occulta is probably the most common anomaly of the spine and is most frequent in the lumbosacral area. Bohart, studying a large number of railroad workers with known spina bifida, found that men with this anomaly were not more liable to injury and disability than others not so affected. He found the same to be true in the cases

of patients with sacralization of the fifth lumbar vertebra.—*Edward N. Reed, M.D., Santa Monica, California.*

**MULTIPLE MYELOMA.** David E. Ehrlich. *Radiology*, XXIII, 418, Oct. 1934.

Multiple myeloma is a primary malignant tumor of the bone marrow, characterized by multiple foci, pain, spontaneous fractures, Bence-Jones albumosuria, anaemia, and asthenia. It occurs chiefly in the ribs, spine, sternum, and pelvis of adults. It is uncommon in occurrence, insidious in onset, difficult to diagnose, and the prognosis is hopeless.

*Pathology:* Grayish and reddish masses appear simultaneously in spongy bone or in the medullary canal and, as they slowly grow, excite active resorption of the bone. Subsequent bending and breaking of the bone take place, due to the loss of mineral salts. Gradual thinning and perforation allow pathological fractures to occur, although they are accompanied by little or no pain and are followed by soft tumor masses over the bone.

*Röntgenographic Appearance:* The lesions are seen to be punched-out, rarefied areas, widely scattered through the skeleton. The cortex is not destroyed, but expansion of the shaft may be noted.

*Diagnosis:* The presence of Bence-Jones albumosuria is a helpful diagnostic point, but it is not altogether pathognomonic of multiple myeloma.

The prognosis is poor. The duration of life has varied from eight months to from eight to eleven years, with an average of less than two years. X-ray treatment in light doses relieves the pain markedly and may prolong life.

Detailed histories of seven cases are given.—*Edward N. Reed, M.D., Santa Monica, California.*

**VNITŘNÍ PORANĚNÍ KOLENA (Internal Derangement of the Knee).** Bedřich Frejka. *Slovanský Sborník. Ortop.*, IX, 108, 1934.

The author lays stress on the need of recognizing at the time of first treating the patient the character of the injury and the urgency of protecting the structures of the knee joint. He states that the simple injuries of the meniscus give the best functional results, and a return of function to 100 per cent. should be expected. In other injuries of the knee the prognosis is less favorable. The complete return of strength to the joint can be expected only after the atrophy of the quadriceps is eliminated by exercise. Of thirty-two cases of knee injuries, twenty-four were injuries of the meniscus.

**PRÍLOG OPERATIVNOM LEČENJU ZASTARELIH IŠČAŠENJA LAKTA (Operative Treatment of Old Dislocation of the Elbow).** Borivoje Gradojević. *Slovanský Sborník. Ortop.*, IX, 185, 1934.

Three cases are reported with the methods used and the results. Two patients were treated by arthrotomy and one by a semi-articular resection. In all three cases, the incision of Ollier gave free and satisfactory access to the joint. In the arthrotomies the capsules were opened parallel to the olecranon. In one of these cases, the patient was a girl of eleven years, with a dislocation of one month and eight days' duration; in the other, the patient was a man of twenty-three years, with a dislocation of four and a half months' duration. The result in the first case was excellent and in the second case fair. The case of resection was that of a woman of fifty-six years, with a dislocation of seven and one-half months' duration. There was ankylosis of one of the articular ends of the bones and it was necessary to resort to excision of this portion.

In the case of an arthrotomy, the author considers that the lateral incision of the capsule with transection of the olecranon presents the best route.



PRIOLOG OPERATIVNOM LEČENJU ZASTARELIH IŠČAŠENJA RAMENA (Operative Treatment of Old Dislocation of the Shoulder). Borivoje Gradojević. *Slovanski Sbornik. Ortop.*, IX, 194, 1934.

The author reports the results obtained in two cases of old dislocation of the shoulder treated by arthrotomy. The approach was made by the transacromial route which gave an excellent exposure and allowed easy reduction of the deformity. The first case was that of a man fifty-one years of age who was operated on two and a half months after the accident with only partial success. The second case was that of a man thirty-eight years old who was operated on nine weeks after the accident with an excellent result.

ARTHROKATADYSIS OF THE HIP JOINT. Moses Gellman. *Southern Med. J.*, XXVII, 215, 1934.

Three cases of this rather rare condition are reported and the etiology is discussed. The outstanding characteristics of this condition are: protrusion of the acetabulum with eburnation, preservation of the femoral head and its migration into the acetabulum, and shortening of the extremity.—*Fred G. Hodgson, M.D., Atlanta, Georgia.*

ALKALINIZATION AND ACIDIFICATION OF WOUNDS AND INFLAMMATORY AREAS. A. Mannheim. *Soviet Surg.*, VI, 117, 1934.

After a theoretical review, the author describes his method of alkalization of wounds and abscesses. This method consists of the local application of a combination of six and one-half grams each of sodium chlorate and sodium phosphate with 1000 cubic centimeters of water. Simultaneously ten grams of sodium bicarbonate is administered daily by mouth. Results are very satisfactory. This method, however, has not proved successful in the treatment of osteomyelitis.—*Emanuel Kaplan, M.D., New York, N. Y.*

OPERATIVE TREATMENT OF HABITUAL BACKWARD DISLOCATION OF THE SHOULDER. A. Kaplan. *Soviet Surg.*, VI, 195, 1934.

This dislocation is infrequent. The author describes one case in which the following operative procedure was used, with a lasting good result. An incision is made along the posterior aspect of the deltoid muscle, with exposure of the axillary nerve and vessels, and another incision is made parallel to the anterior border of the deltoid. A flap, eighteen centimeters long and three centimeters wide, is made from the anterior portion of the deltoid muscle at the clavicle. A tunnel is constructed bluntly through the posterior incision, in a forward direction above the axillary artery. The deltoid flap is then pulled back through the tunnel, thus supporting the head of the humerus. This flap is then attached to the insertion of the teres minor, and the capsule is plicated. The patient is then immobilized in a position of moderate abduction.—*Emanuel Kaplan, M.D., New York, N. Y.*

RESECTION FOR SHORTENING A NORMAL LOWER EXTREMITY. L. Pevsner. *Soviet Surg.*, VI, 233, 1934.

The author reports a case of a patient twenty-one years old who had a tuberculous hip disease in early childhood. It left him with a shortening of seven centimeters of the affected extremity. There was a fair range of motion in the hip. Instead of a bone lengthening of the afflicted extremity, resection of a fragment seven centimeters long was done on the femur of the normal side. Good function and normal gait resulted in four months.—*Emanuel Kaplan, M.D., New York, N. Y.*

## DOUBLE EXPOSURE PHOTOGRAPHY AS A METHOD OF STUDY OF DISEASES OF THE SPINE.

K. Barishnikov. *Soviet Surg.*, VI, 243, 1934.

The patient is first photographed in a standing position; then, without changing his place, he is photographed again on the same plate in the position of maximum forward flexion. This plate can be kept as a reliable record of his range of motion and, together with the roentgenograms of the spine, may be a valuable source of information.—*Emanuel Kaplan, M.D., New York, N. Y.*

ZUR FRAGE DER POLSTERUNG DES GIPSVERBANDES BEI BEHANDLUNG DER KNOCHENBRÜCHE (Padded and Unpadded Casts in the Treatment of Fractures). Otto Frisch. *Wiener klin. Wchnschr.*, XLVII, 143, 1934.

Following the publication of articles by Schnek in 1931, in regard to his success and that of Böhler with the use of unpadded casts in the treatment of fractures in the Vienna Emergency Hospital, the author tried this procedure in a large number of his cases, and in this article compares the relative merits of the padded and unpadded casts.

Unpadded casts were first introduced in fracture therapy by Bardeleben in 1890, and have proved more advantageous than padded casts in some conditions. The basic and most significant objection to unpadded circular casts is the tendency to diminish the vascular and, consequently, the nutritional supply to the parts enclosed. This fact was apparently overlooked by Schnek. The absolute inelasticity of the unpadded cast is also a disadvantage encountered in the majority of cases, because swelling of the affected parts may always be expected. Again, in cases of large hematomata, a marked diminution in size of the affected part may occur in seven to ten days, and when unpadded casts are used, a partial loss of constant and efficient immobilization results; this condition is much less frequent when padded casts are used. The cases treated in Böhler's Clinic during the past five years by padded casts reveal none of the skin or other complications such as are seen in Schnek's cases.

The author indicates his particular procedure, materials used, etc. A properly applied padded cast is less painful than a similar unpadded one; there is less tendency to decubitus and less danger of cutting the body during removal of the cast.

The author recognizes the convenience of the unpadded casts in the treatment of ambulatory patients, but considers that the use of such casts involves too great a risk. However, in cases of fracture of the forearm or lower leg, he frequently employs the unpadded cast as the second cast which is applied three or four weeks after the injury.—

*Paul H. Rempel, M.D., Oklahoma City, Oklahoma.*

MISSBILDUNG DES DISTALEN UNTERSCHENKELENDEN NACH SCHÄDIGUNG DER EPIPHYSEN-SCHIBEIN (Deformities of the Distal End of the Tibia after Injuries to the Epiphyseal Discs). J. van Assen. *Ztschr. f. orthop. Chir.*, LX, 455, 1934.

Three cases of traumatic separation of the epiphysis are reported,—two cases of direct injury to the epiphysis and the third case in which injury to the epiphysis occurred after repeated redressment of a resistant club foot. Two cases are also reported in which the lower end of the fibula disappeared through inflammatory destruction. In one of these a portion of the tibia, containing the epiphysis and epiphyseal disc, was used for reconstruction of the lower end of the fibula. After this operation the newly formed fibula participated in normal growth.—*Arthur Steindler, M.D., Iowa City, Iowa.*

ZUR FRAGE DER ENDERGEBNISSE DER REFONIIERTEN HÜFTLUXATION (End Results of Reduced Congenital Hip Dislocation). F. Schöde. *Ztschr. f. orthop. Chir.*, LX, 474, 1934.

The late end results which are available today represent cases in which operation was performed at least fifteen years ago. According to Becker, in only one-eighth of the

cases is there true, permanent cure; this indicates that the treatment of the condition then in vogue was not such as to guarantee a permanent cure. This, however, does not apply to the present technique of treatment. If present methods were the same as those practised two decades ago, we should probably have to expect the same end results. However, the present method of treatment is so radically different that a comparison of its efficacy with the older methods is no longer permissible.

The original method has been changed in two essential points:

1. Introduction of very early treatment. The sooner the treatment is instituted, the greater is the prospect of normal reconstruction of the joint and, consequently, of a permanent cure.

2. Difference in the after-treatment. Systematic and consistent after-treatment is carried out, directed principally toward the maintenance of the positions between head and acetabulum and the careful limitation of movements. Treatment is continued until it appears that the reconstruction of the acetabular roof has been completed. Another point in the after-treatment is the careful observation of the reconstruction of the head. Inasmuch as the head deformity is a physiological transformation process, it must be carefully watched and the amount and duration of weight-bearing must be restricted.

Of interest is the author's opinion that there is hardly such a thing as a unilateral dislocation of the hip because the apparently sound side almost always shows changes in the nature of a flattened acetabulum. Although a dislocation does not occur, the functional relations between the shallow acetabulum and the head are by no means normal, and the condition eventually leads to severe secondary changes. Not infrequently a hip that has never been dislocated or treated comes to complete dislocation during puberty. If both hips are treated, the non-luxated, non-dislocated or flattened acetabulum gradually becomes transformed to one of normal depth.

Interesting as the study of the late end results of congenital dislocation treated in former periods may be, it cannot be said that such a study is of value for the critical analysis of the present treatment. It is to be expected that in the next ten years the late end results will assume a different aspect.—*Arthur Steindler, M.D., Iowa City, Iowa.*

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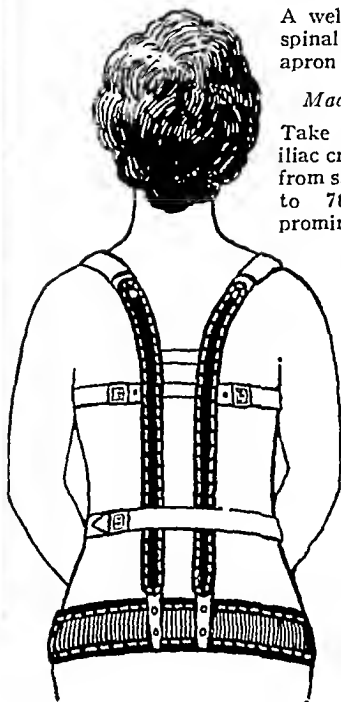
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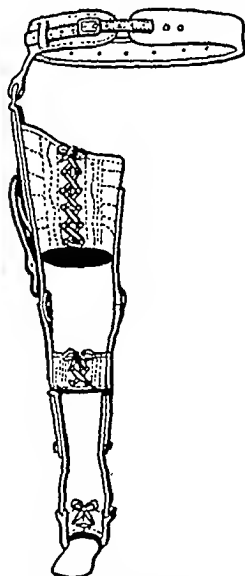
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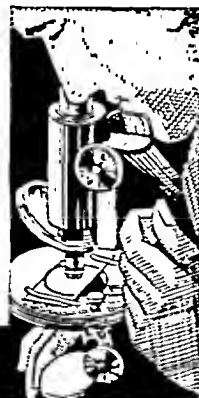


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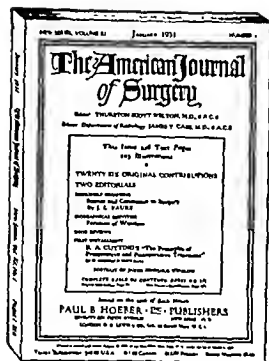
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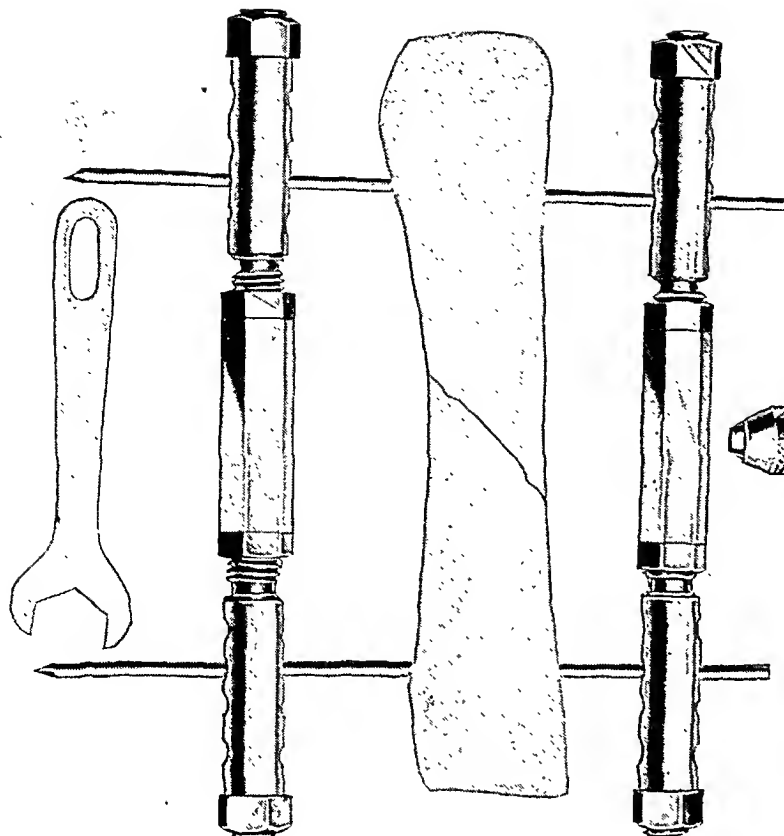
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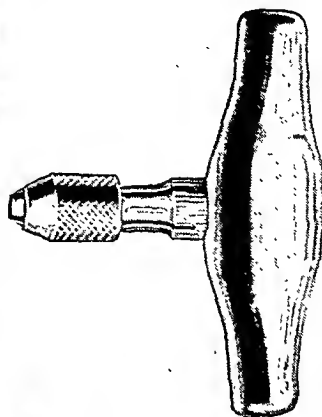




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